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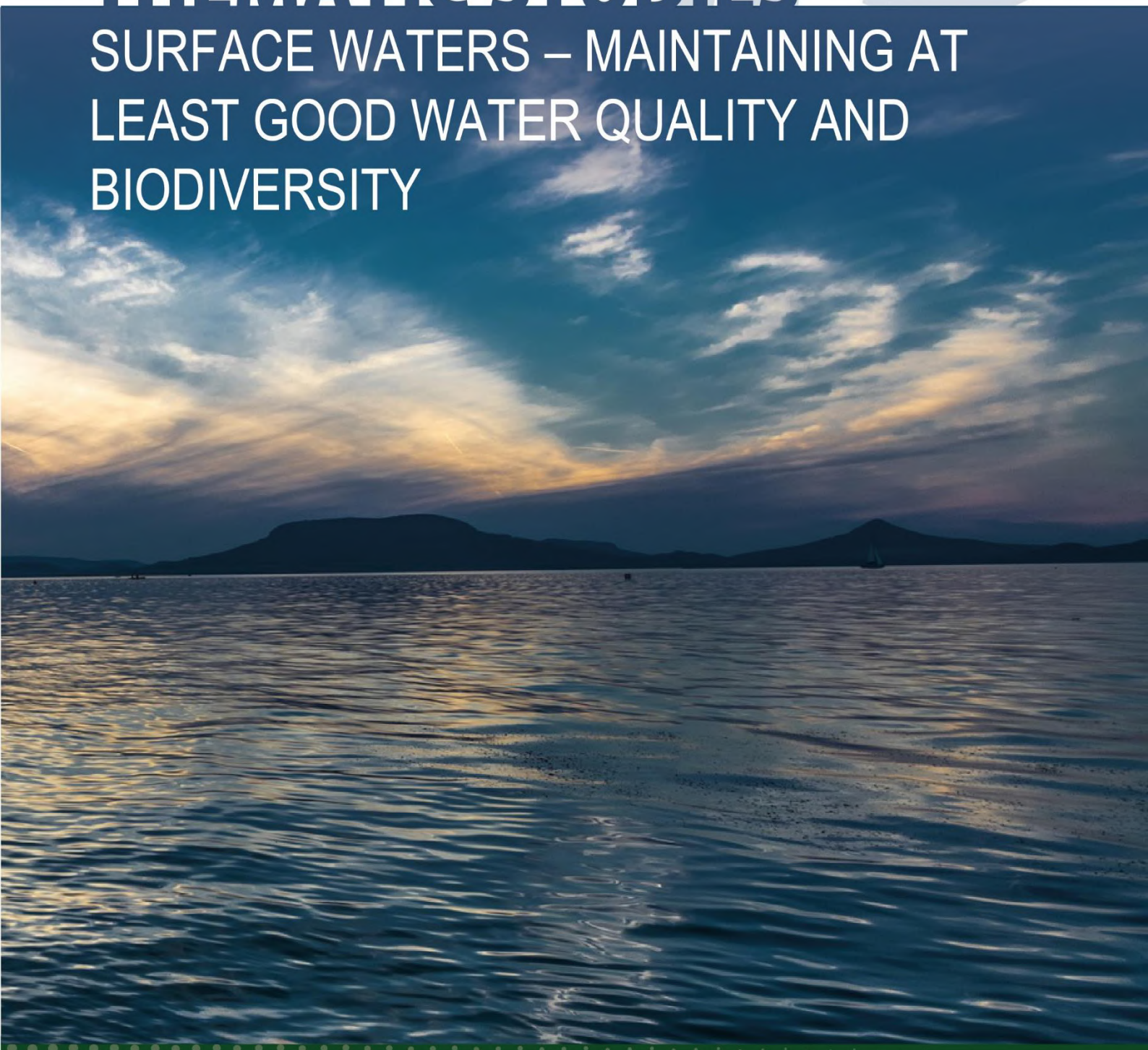
FRESHWATER THEMATIC STUDIES

SURFACE WATERS – MAINTAINING AT LEAST GOOD WATER QUALITY AND BIODIVERSITY



THEMATIC STUDY OF THE BIOEAST THEMATIC WORKING GROUP ON FRESHWATER

Surface waters – maintaining at least good water quality and biodiversity

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1. Introduction

"Water is not a commercial product like any other but, rather, a heritage which must be protected, defended and treated as such." - Water Framework Directive (WFD, Directive 2000/60/EC)[1].

The WFD stipulates that EU Member States should aim to achieve at least good ecological status or potential and chemical status for all surface water bodies, and chemical status and quantitative status of groundwater. Ecological status/potential of surface waters express the criteria used to assess the quality of the structure and functioning of surface water ecosystems, which are influenced by pollution and habitat degradation. For these waters, good chemical status means that no concentrations of priority substances exceed the relevant values established in the Environmental Quality Standards Directive 2008/105/EC[2] (as amended by the Priority Substances Directive 2013/39/EU[3]). For groundwater, good chemical status means that hazardous substances should not be present, and the introduction of all other pollutants (e.g. nitrates) should be limited whereas good quantitative status is related to ensuring that the available groundwater resource should not be reduced by the long-term annual average rate of abstraction. Furthermore, each impact on surface waters linked with groundwater or on groundwater-dependent terrestrial ecosystems should be also avoided.

The river basin management plans (RBMPs, the first RBMPs in 2009 and the second RBMPs in 2018) were published to identify the achievement of the environmental objectives of the WFD in EU countries. The next third RBMPs (for the period up to 2021) will be drafted in the near future.

Generally, the data currently available from the first and second RBMPs confirmed that EU Member States have reported status for 13 400 groundwater bodies and 111 000 surface water bodies including 80% of rivers, 16% of lakes and 4% of coastal or transitional waters (EEA 2018)[4][5]. It was found that approximately 40% of the surface water bodies were in at least good ecological status or potential, while 60% have not achieved the goal of a good status/potential. Similarly, 38% of surface water bodies were classified into good chemical status, while 46% failed in achieving good chemical status. Furthermore, 16% surface waters had unknown status. Regarding the groundwater bodies in the EU, a total of 74% of their area was in good chemical status.

[1] Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy. Official Journal L 327, 22/12/2000 P. 0001 - 0073
[2] Directive 2008/105/EC of the European Parliament and of the Council of 16 December 2008 on environmental quality standards in the field of water policy, amending and subsequently repealing Council Directives 82/176/EEC, 83/513/EEC, 84/156/EEC, 84/491/EEC, 86/280/EEC and amending Directive 2000/60/EC of the European Parliament and of the Council, Official Journal of the European Union L 348/84
[3] Directive 2013/39/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 12 August 2013 amending Directives 2000/60/EC and 2008/105/EC as regards priority substances in the field of water policy, Official Journal of the European Union L 226/1
[4] European Environment Agency (2018) European waters – assessment of status and pressures 2018. EEA Report No 7/2018 - https://www.eea.europa.eu/publications/state-of-water
[5] European Commission 2019. Report from the Commission to the European parliament and the council on the implementation of the Water Framework Directive (2000/60/EC) and the Floods Directive (2007/60/EC) Second River Basin Management Plans First Flood Risk Management Plans. COM/2019/95 final

1.1. Objectives

This thematic study concerns the entire BIOEAST region including eleven European countries. The main objectives were to:

1. analyze the current situation of the ecological status/potential and chemical status of surface water bodies and groundwater bodies in the eleven BIOEAST countries,
2. describe the Region´s potential, tools, risks and barriers,
3. suggest a possible opportunity of implementation plan for the fresh water based bioeconomy in the respective value chains.

All tasks cover:

a) the current ecological status/potential and chemical status of surface water bodies, and chemical and quantitative status of groundwater bodies with specifying the trends of the development, based on the real data of the eleven BIOEAST countries;
b) the legal documents concerning the national and European Union levels;
c) the networking potential in each BIOEAST country – main institutions and leaders; including the responsibilities and contact info, the areas of networking;
d) the promising areas and instruments for current and future cooperation.

1.2. Study methodology

The thematic study covers the eleven BIOEAST countries, i.e. Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovak Republic, Slovenia.

Analyses of all aspects related to ecological status/potential and chemical status of surface water bodies and chemical and quantitative status of groundwater bodies in each BIOEAST country include:

1. reviewing of available references and gathering data on freshwater ecosystems to (1) create the database, (2) visualize them, (3) specify the trends in the development, and (4) suggest the implementation plan;
2. an overview of the available current legal documents related to the national and European Union levels;
3. analysis of the current networking potential in each country – main institutions and leaders, including identification of responsibilities, potential instruments and political, economic and legal barriers, contact info and the areas of networking;
4. identification of the promising areas and instruments for the cooperation;
5. the country analysis based also on the questionnaire and the close cooperation with the members of the TWG Freshwater based economy;
6. a suggestion of implementation plan, in particular at the bi-regional EU – BIOEAST level Green Deal, EU Biodiversity Strategy, Zero Pollution Plan, the Sustainable Development Goals and Circular Economy Action Plan;
7. analysis of SWOT (Strengths, Weakness, Opportunity, Threats) for the BIOEAST region, to facilitate the transition from the stage of "Understanding the Nexus" to "Nexus Doing" in order to strengthen resilience, and as well maintain the good water quality status.

The database for all BIOEAST countries was created according to Water Information System for Europe (WISE) of Water Framework Directive Database in which all EU Member States had reported data on the ecological status/potential and chemical status of surface waters and data on chemical and quantitative status of groundwater to the European Commission. The available data cover data from the first RBMPs and the second RBMPs, which were published

in 2009 and 2018, respectively. The reporting for the next period up to 2021 is currently in progress.

The questionnaire used for this study was sent to international respondents from different countries and it was used as supplemented data (ANNEX 1).

1.3. Concept

1. Based on the identified state-of-the-art knowledge about current ecological and chemical status of surface and ground waters it will be possible to present some trends of the development using the proper tools.
2. Based on review of available current legal documents related to the national and European Union levels and networking potential in each country it will be possible to verify the responsibilities, potential instruments and political, economic and legal barriers.
3. Based on identifying the promising area and instruments for cooperation it will be possible to suggest the possible implementation plan, in particular at the bi-regional EU – BIOEAST level.
4. Based on the achievement of all objectives it will be possible to propose a common pursuit and background for science and evidence-based implementation of the European Green Deal and the Sustainable Development Goals, notably the SDG 6 “Ensure availability and sustainable management of water and sanitation for all”.

2. Main outcomes

2.1. Current state of water quality in BIOEAST countries

Table 1 presents the number of each water body type used in this thematic study. Only in Slovak Republic, any data on status of lakes, coastal or transitional waters were not given.

Table 1: **The number of each water body type used for this studies**

Country	Rivers	Lakes	Coastal or transitional waters	Groundwater
Bulgaria	873	37	45	158,602
Croatia	1,484	37	51	55,802
Czech Republic	1,044	77	0	88,079
Estonia	645	89	16	113,028
Hungary	963	115	0	279,641
Latvia	203	259	8	76,211
Lithuania	817	357	6	64,974
Poland	4,586	1,044	19	311,981
Romania	2,891	130	6	267,804
Slovak Republic	1,510	0	0	77,410
Slovenia	137	12	5	20,273

Source: WISE electronic reports from the second RBMPs, 2018 (https://www.eea.europa.eu/themes/water/european-waters/water-quality-and-water-assessment/water-assessments/ecological-status-of-surface-water-bodies)
River water bodies – catchment > 10 km^2, except for Slovenia catchment > 100 km^2; lake water bodies – area > 50 ha; coastal or transitional water bodies; groundwater bodies – area, km^2

Only 8% of river surface water bodies in Hungary met the WFD required at least good ecological status or potential (Fig. 1). In other countries, this goal was achieved for ca. 20% (Czech Republic, Latvia) through 31% (Poland), 42-49% (Croatia, Bulgaria and Lithuania), 56% (Slovak Republic), 60% (Estonia, Slovenia) to 66% (Romania).

Approximately 9% of river water bodies had unknown status in Hungary and Bulgaria whereas 2% in Slovenia and below 1% in Czech Republic, Estonia and Poland.

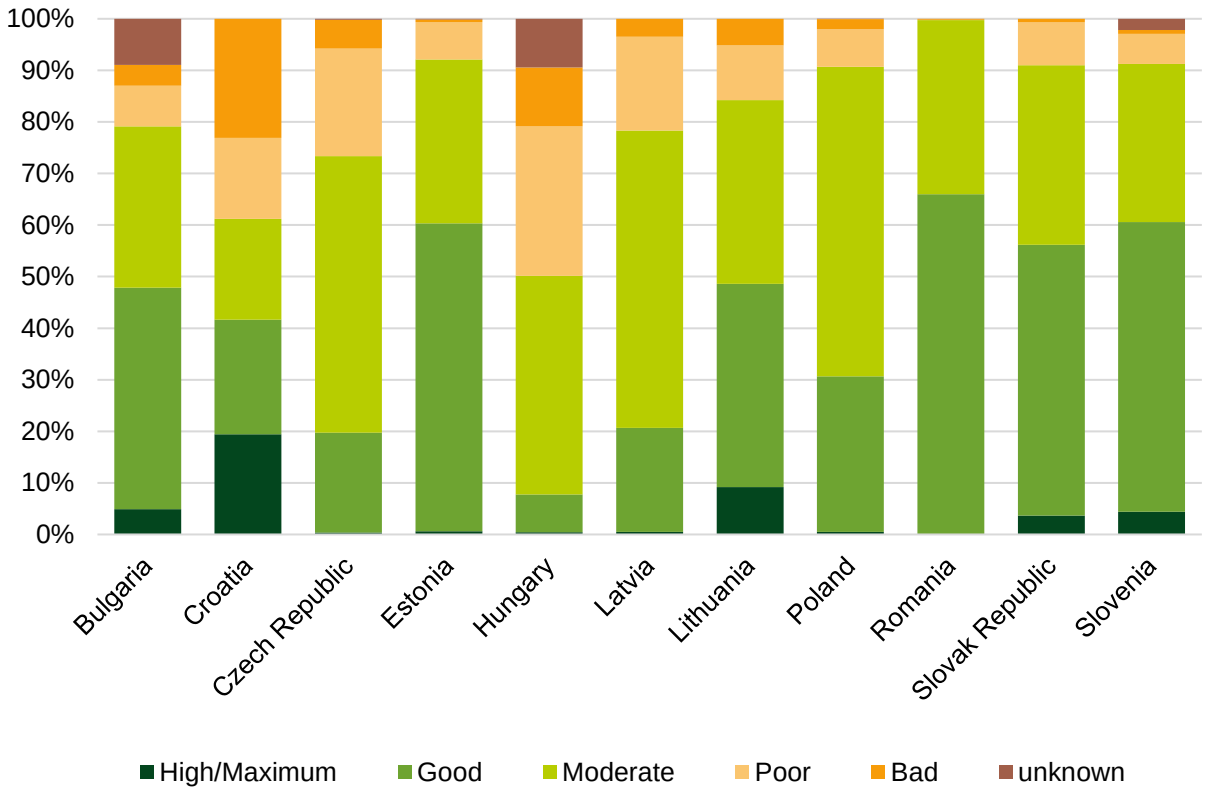

Figure 1: **Ecological status or potential of surface water bodies: rivers**

Source: WISE electronic reports from the second RBMPs, 2018 (https://www.eea.europa.eu/themes/water/european-waters/water-quality-and-water-assessment/water-assessments/ecological-status-of-surface-water-bodies)

In case of lake surface water bodies, only 12% of lakes had at least good (good plus high or maximum) ecological status or potential in Czech Republic and Hungary, and 22% in Latvia (Fig. 2). Next, 33-35% of the lakes in Slovenia, Poland and Bulgaria met the WFD required at least good status/potential whereas 45% in Croatia. Next, 60%, 67% and 72% of the lakes had at least good status/potential in Lithuania, Estonia and Romania, respectively. Only in Slovak Republic, there was not any available information on the lakes.

Approximately 47% of lake water bodies had unknown status/potential in Hungary, next 22% in Czech Republic and 16% Bulgaria. In Romania, the lakes with unknown status/potential constituted 5% of all lakes.

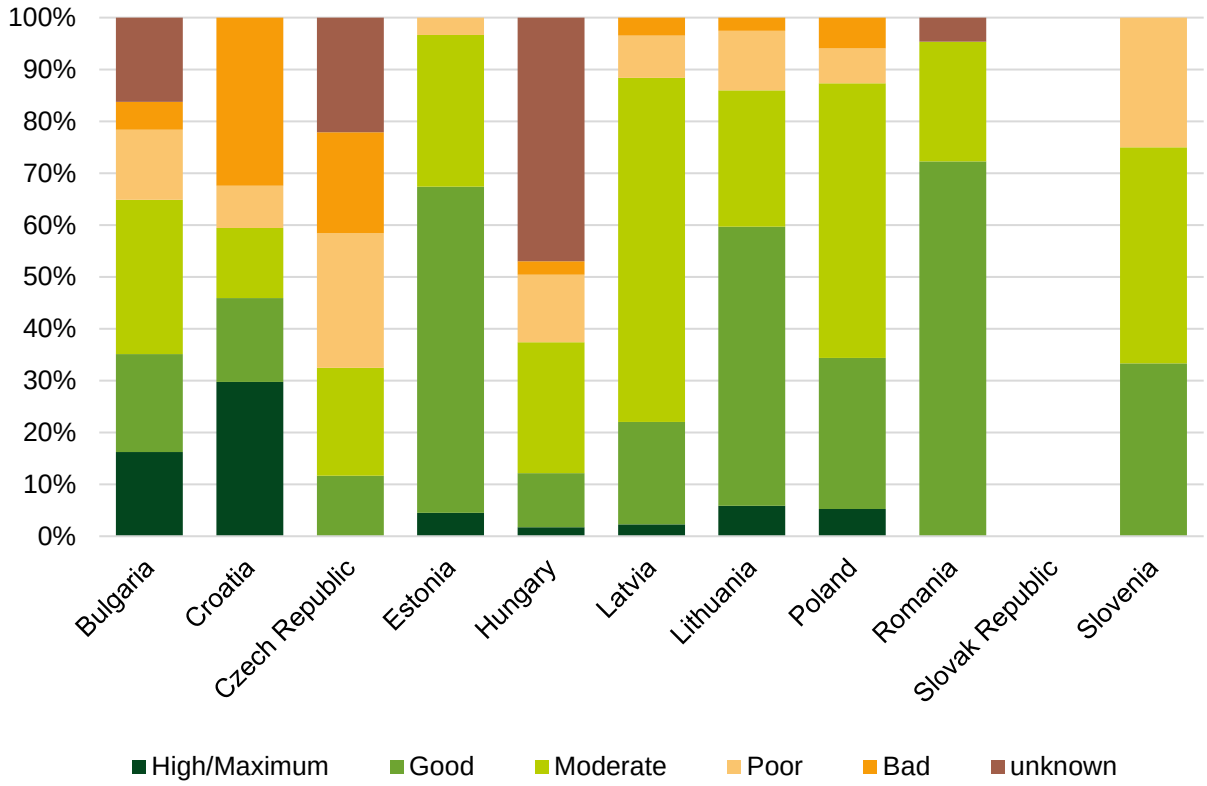

Figure 2: **Ecological status or potential of surface water bodies: lakes**

Source: WISE electronic reports from the second RBMPs, 2018 (https://www.eea.europa.eu/themes/water/european-waters/water-quality-and-water-assessment/water-assessments/ecological-status-of-surface-water-bodies)

In four countries: Latvia, Lithuania, Poland and Romania, all coastal and transitional waters failed in achieving at least good ecological status/potential (Fig. 3). 13%, 20%, 53% of coastal and transitional waters were classified with at least good status/potential in Estonia, Bulgaria, and Croatia, respectively. Only in Slovenia, 60% and 40% of these waters had good and unknown status/potential, respectively.

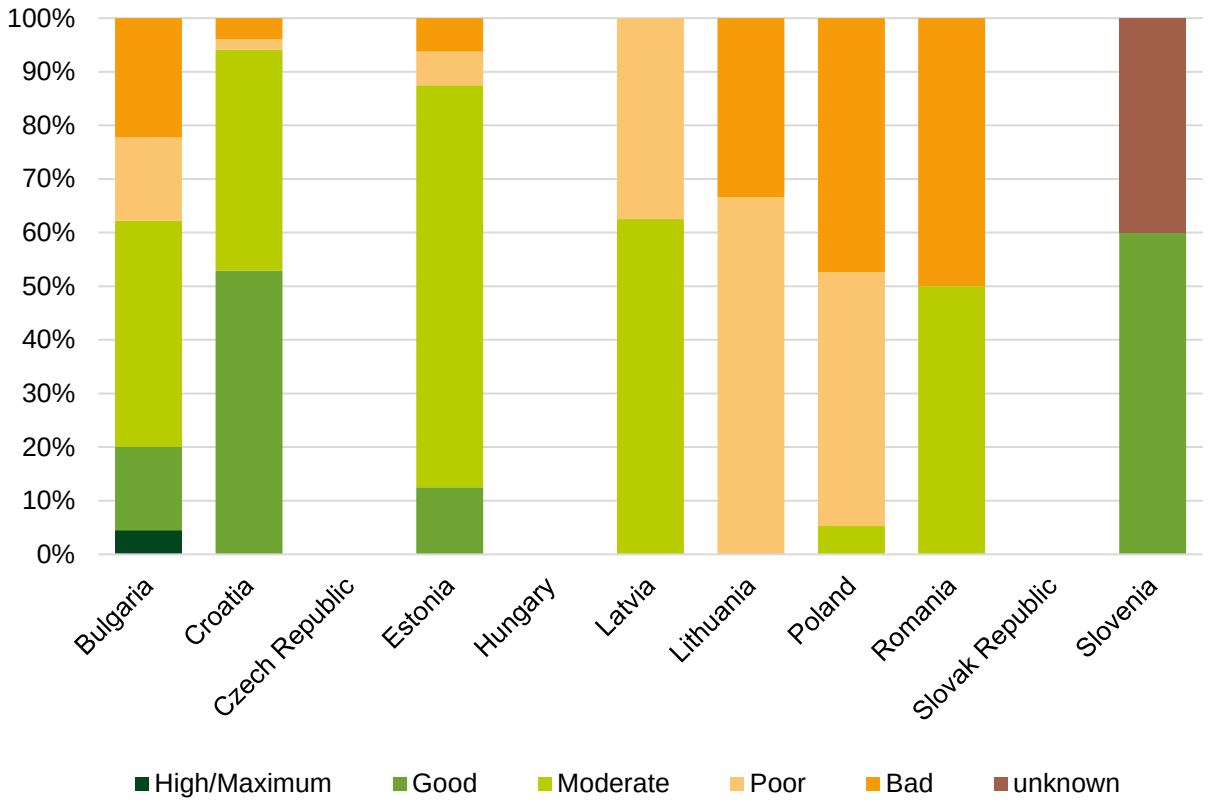

Figure 3: **Ecological status or potential of surface water bodies: coastal and transitional waters**

Source: WISE electronic reports from the second RBMPs, 2018 (https://www.eea.europa.eu/themes/water/european-waters/water-quality-and-water-assessment/water-assessments/ecological-status-of-surface-water-bodies)

Concerning chemical status, only one river water body (and 1% of total numbers) with good chemical status was recorded in Slovenia, whereas other water bodies failed in achieving this status (Fig. 4). In Estonia, 11% of river water bodies had good status and 89% had unknown status. Similar situation was recorded in Estonia (20% and 76%, respectively). Next, in Bulgaria and Hungary good chemical status had 35% and 47% of river water bodies, respectively. Whereas unknown status had 62% and 45% of river water bodies, respectively. In other countries, the majority of rivers (68-98%) was classified as having good chemical status.

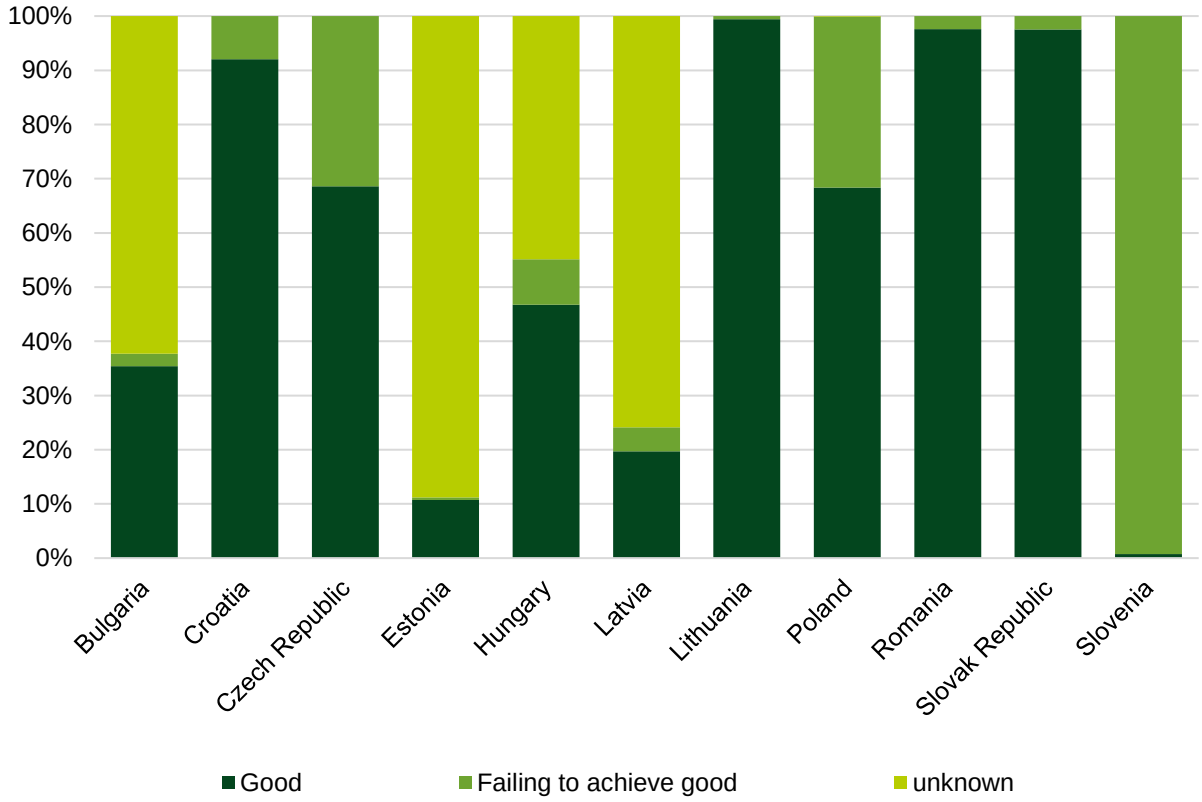

Figure 4: **Chemical status of surface water bodies: rivers**

Source: WISE electronic reports from the second RBMPs, 2018 (https://www.eea.europa.eu/themes/water/european-waters/water-quality-and-water-assessment/water-assessments/chemical-status-of-surface-water-bodies)

In three counties: Croatia, Lithuania and Romania, all studied lakes (100%) achieved good chemical status (Fig. 5). This goal was achieved by the majority of lakes, i.e. 68%, in Czech Republic. All lakes (i.e. 100%) in Slovenia had unknown chemical status. Next, very high and high shares of lakes with unknown chemical status were identified in Estonia (98%), Latvia (94%), Poland (78%), Bulgaria (73%) and Hungary (60%).

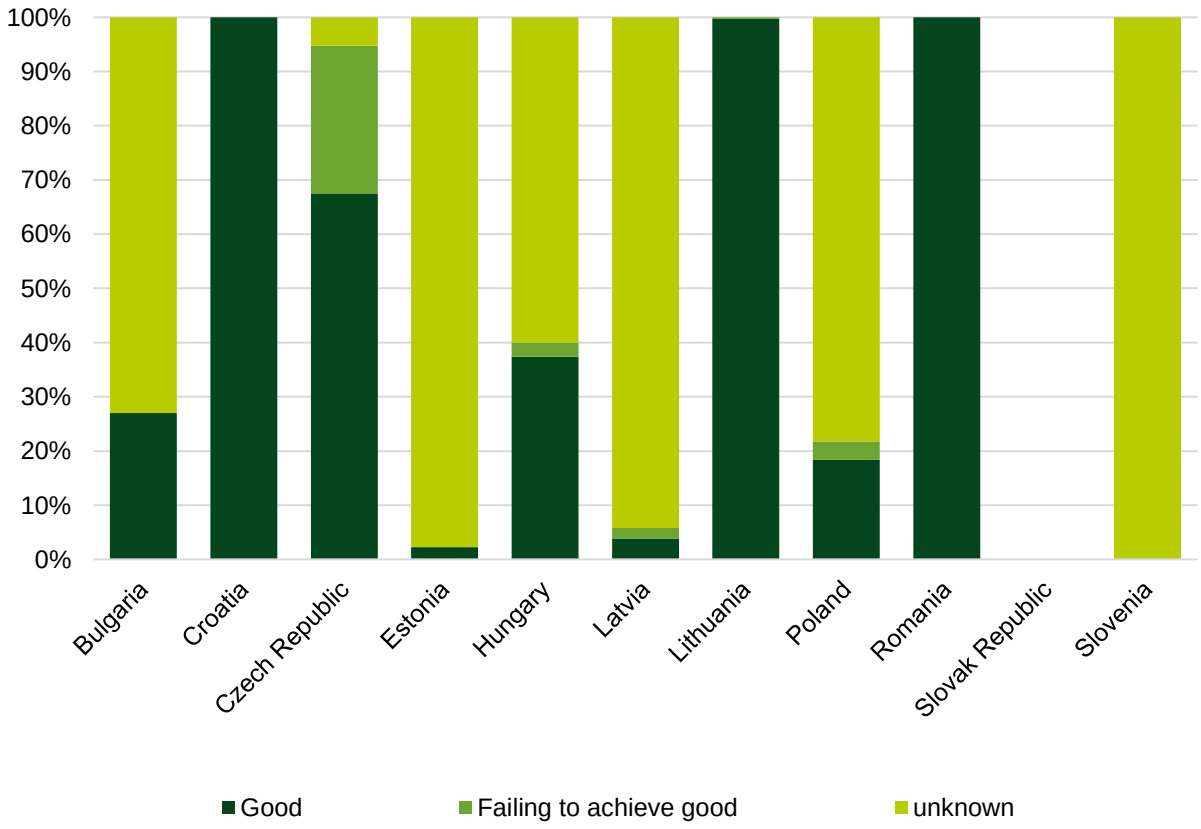

Figure 5: **Chemical status of surface water bodies: lakes**

Source: WISE electronic reports from the second RBMPs, 2018 (https://www.eea.europa.eu/themes/water/european-waters/water-quality-and-water-assessment/water-assessments/chemical-status-of-surface-water-bodies)

In case of coastal and transitional waters, 100% of them achieved a good chemical status in Romania, and 78% of them in Croatia (Fig. 6). Next, in Poland it was only 29%, in Lithuania – 17% and in Bulgaria – 7%. Concerning the failing to achieve good chemical status, 100% of coastal and transitional waters were recorded in Latvia, 83%-75% were in Lithuania, Slovenia and Estonia. In Bulgaria 82% of these waters had unknown chemical status, whereas in other three countries – from 20 to 37% of waters were in this status.

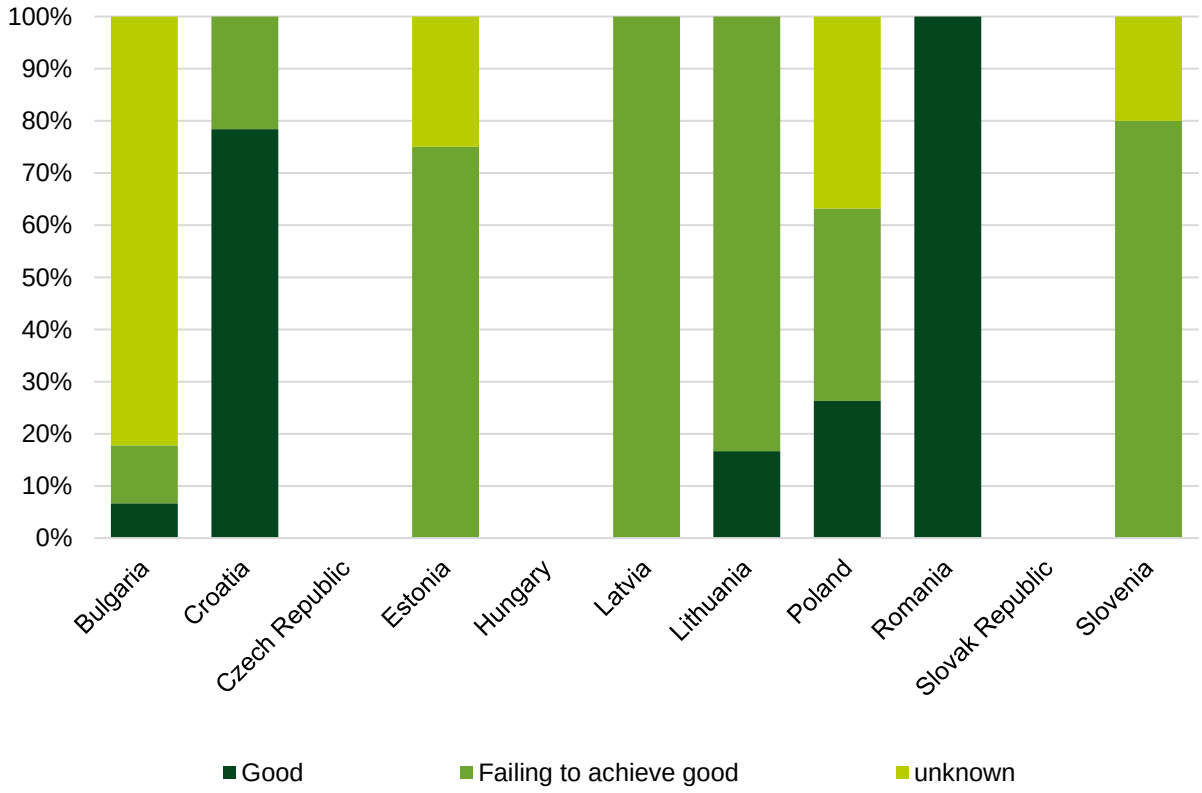

Figure 6: **Chemical status of surface water bodies: coastal and transitional waters**

Source: WISE electronic reports from the second RBMPs, 2018 (https://www.eea.europa.eu/themes/water/european-waters/water-quality-and-water-assessment/water-assessments/chemical-status-of-surface-water-bodies)

Almost all BIOEAST countries had good quantitative status in case of majority groundwater bodies (Fig. 7). In Latvia, Lithuania, Romania and Slovenia there were recorded 100% of such waters, in Bulgaria, Croatia and Estonia – 99%, in Poland – 96%, in Czech Republic – 89%. In Hungary, the total of 75% of groundwater bodies had good quantitative status whereas 25% had poor quantitative status. In Slovak Republic, 74% of these waters were in good, 3% in poor and 23% in unknown status.

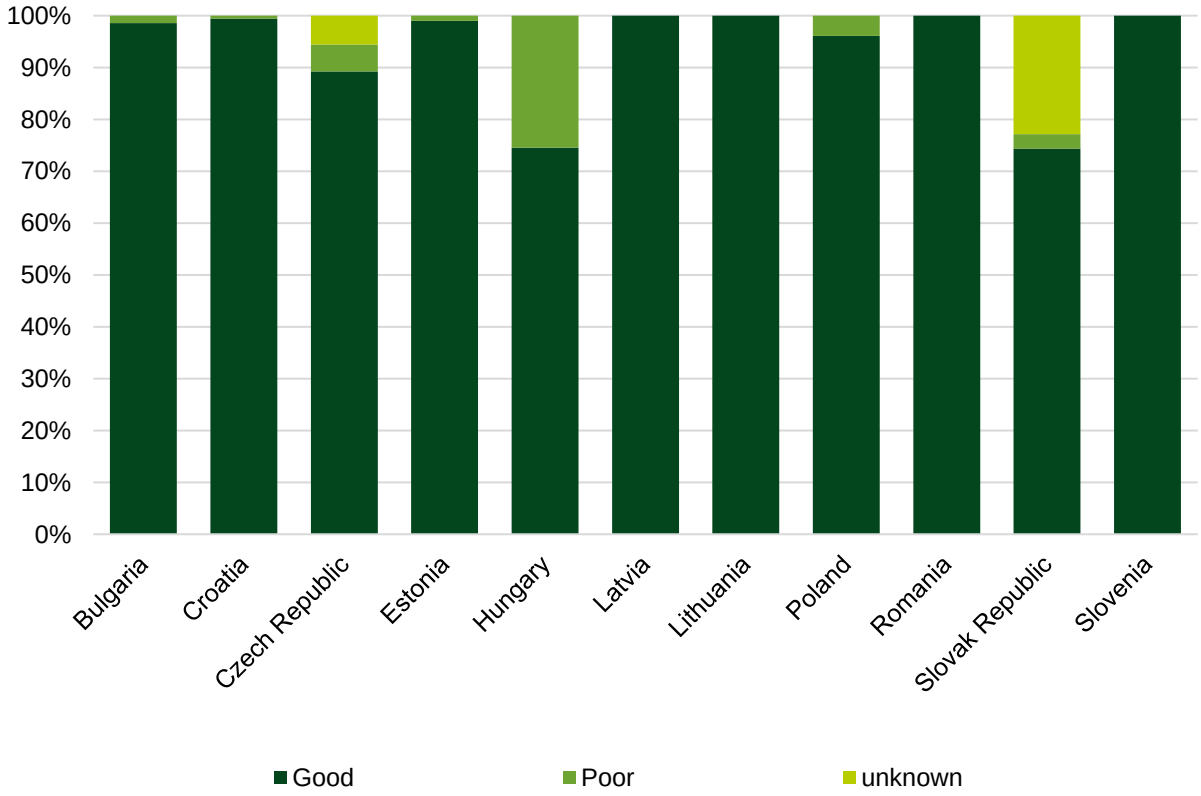

Figure 7: **Quantitative status of groundwater bodies**

Source: WISE electronic reports from the second RBMPs, 2018 (https://www.eea.europa.eu/themes/water/european-waters/water-quality-and-water-assessment/water-assessments/groundwater-quantitative-and-chemical-status)

Good chemical status had all groundwater bodies in Latvia and Lithuania (Fig. 8). Similar situation (with the share of 92-98%) was recorded in Croatia, Estonia, Slovenia and Poland. In Romania and Hungary, these waters constituted 87% and 83%, respectively. In Slovak Republic, the groundwater bodies having good, poor and unknown status constituted to 60%, 17% and 23%, respectively. Furthermore, about a half of all groundwater bodies in Bulgaria and less than a half in Czech Republic had good chemical status, whereas the rest of waters was classified into poor chemical status.

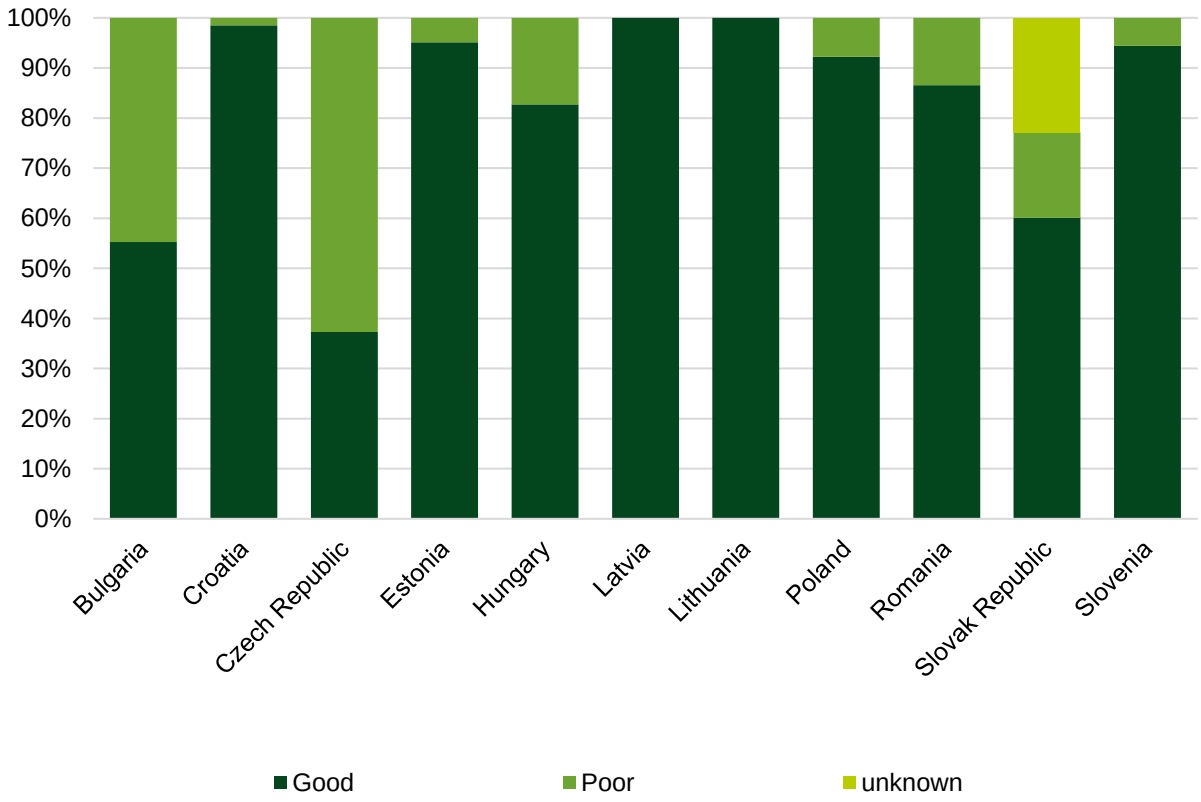

Figure 8: **Chemical status of groundwater bodies**

Source: WISE electronic reports from the second RBMPs, 2018 (https://www.eea.europa.eu/themes/water/european-waters/water-quality-and-water-assessment/water-assessments/groundwater-quantitative-and-chemical-status)

2.2. Trends in the development of water policy in BIOEAST macro-region

The entire BIOEAST macro region is committed to achieving at least good (high plus good) water quality what is connected with:

1. strict integration of the River Basin Management Plans with Flood Risk Management Plans;
2. ensuring that Habitat and Birds Directives are complied with Protected Areas, and Safeguard zones for the protection of Drinking Waters are established;
3. implementation of a Common Implementation Strategy guidance document on how to adapt to climate change;
4. following the objectives of WFD, Floods Directive and Natural Water Retention Measures and tackle significant pressures;
5. helping in achieving Good Environmental Status of EU marine waters through EU Mission: Restore our Ocean and Waters with targets of protecting 30% of the EU's sea area and restoring marine eco-systems and getting 25,000 km of free-flowing rivers, preventing and

eliminating pollution especially reducing plastic litter at sea, nutrient losses and use of chemical pesticides by 50% and contributing to make the blue economy climate-neutral and circular with net-zero maritime emissions.

The expectation to achieve at least good ecological status/potential, good chemical status of surface water bodies and good chemical and quantitative status of groundwater bodies in 2015, 2021 and 2027 were analyzed in each BIOEAST country. The results were presented in Table 2. It is excepted that majority of BIOEAST countries will achieve good status of water until 2027. Only, in case of three countries: Bulgaria, Czech Republic and Hungary good status of water bodies can be achieved beyond 2027, whereas in Croatia it can be achieved, but in unknown term.

Table 2: **The percentage of water bodies which were and still are expected to achieve good status in given term**

Country	2015	2021	2027	beyond 2027	Unknown term
Bulgaria	59%	20%	18%	2%	
Croatia	46%	1%	1%		52%
Czech Republic	21%	5%	57%	17%	
Estonia	63%	17%	19%		
Hungary	8%	7%	33%	51%	
Latvia	21%	69%	10%		
Lithuania	n.d.	n.d.	n.d.	n.d.	n.d.
Poland	36%	47%	17%		
Romania	68%	18%	13%		
Slovak Republic	70%		30%		
Slovenia	62%		38%		

The percentage shares in Table 2 have been calculated on the basis of the total number of water bodies, including water bodies with unknown current status.
Source: WISE electronic reports.

The achievement of good status of all surface freshwater bodies and good chemical status of groundwater bodies is expected also to achieve goals of Good Environmental Status of EU marine waters[6]. However, the eleven qualitative descriptors should be fulfilled following that:

1. biodiversity is maintained,
2. non-indigenous species do not adversely alter the ecosystem,
3. the population of commercial fish species is healthy,
4. elements of food webs ensure long-term abundance and reproduction,
5. eutrophication is minimized,
6. the sea floor integrity ensures functioning of the ecosystem,
7. permanent alteration of hydrographical conditions does not adversely affect the ecosystem,
8. concentrations of contaminants give no effects,
9. contaminants in seafood are below safe levels,
10. marine litter does not cause harm,
11. introduction of energy (including underwater noise) does not adversely affect the ecosystem.

[6] https://ec.europa.eu/environment/marine/good-environmental-status/index_en.htm

2.3. SWOT analysis for the BIOEAST macro-region

The SWOT analysis for the entire BIOEAST region was performed based on the separated SWOT analyses of each BIOEAST country (ANNEX 2). The basis for these analyses were primarily river basin management plans (RBMPs) and flood risk management plans (FRMPs). Then, the main outlines were prepared.

Strengths

The main strengths for the BIOEAST REGION include primarily:

1. Defined pressures on surface water bodies: relations 'driving force-pressure-status-impact'.
2. Revised types of water bodies, and majority of assessment methods and classifications.
3. Enlargement the analysis of pressures and implement results from models, projects and research.
4. Governance and public consultations
5. Active involvement of stakeholder groups.
6. International monitoring network of a river convention.
7. Improved effectiveness, and completion level in monitoring and ecological classification.
8. Ensured natural water retention and green infrastructure measures in some countries.

Weaknesses

The main weaknesses for the BIOEAST REGION include primarily:

1. Methodological gaps in monitoring, assessment, criteria, classifications, and some national methodologies for surface water bodies.
2. Lack of complete monitoring of groundwater and all substances causing risk.
3. Water quantity-related problems.
4. Pollution sources - gap assessment for diffuse pollutant loads.
5. High share of water bodies with unknown status (especially ecological status/potential or chemical status of surface water bodies).
6. High share of expert judgment instead of scientific research.
7. Failure to meet the objectives of the WFD for most surface water bodies.
8. No clear distinction between droughts and water scarcity, or even lack of drought management plan in some countries.

Opportunities

1. Positive EU legislation

a) EU Biodiversity Strategy for 2030[7] which is a comprehensive, ambitious, long-term plan for protecting nature and reversing the degradation of ecosystems, and the EU nature restoration targets in which restoring EU's ecosystems will help to increase biodiversity, mitigate and adapt to climate change, and prevent and reduce the impacts of natural disasters;

b) European Green Deal[8] which should transform the EU into a modern, resource-efficient and competitive economy, ensuring reducing net greenhouse gas emissions by at least 55% by 2030, compared to 1990 levels and no net emissions of greenhouse gases by 2050, economic growth decoupled from resource use, and no person and no place left behind;

[7] https://ec.europa.eu/environment/strategy/biodiversity-strategy-2030_en
[8] https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/delivering-european-green-deal_en

c) Towards zero air, water and soil pollution[9] including (1) the zero pollution targets for 2030 with reducing by more than 55% the health impacts (premature deaths) of air pollution; by 30% the share of people chronically disturbed by transport noise; by 25% the EU ecosystems where air pollution threatens biodiversity; by 50% nutrient losses, the use and risk of chemical pesticides, the use of the more hazardous ones, and the sale of antimicrobials for farmed animals and in aquaculture; by 50% plastic litter at sea and by 30% microplastics released into the environment; significantly total waste generation and by 50% residual municipal waste, and (2) the zero pollution vision for 2050: a Healthy Planet for All where air, water and soil pollution will be reduced to levels no longer considered harmful to health and natural ecosystems and that respect the boundaries our planet can cope with, thus creating a toxic-free environment;
d) Political agreement on the new Common Agricultural Policy (CAP): fairer, greener, more flexible[10], in which it is expected that "the new CAP will support the transition towards more sustainable agriculture with increased ambition for climate, environment, and animal welfare"; this will enable implementation through the National Strategic Plans in line with the Green Deal and its Farm to Fork and Biodiversity strategies (from January 2023);
e) Transforming our world: the 2030 Agenda for Sustainable Development[11] with Goal 6. Ensure availability and sustainable management of water and sanitation for all by 2030 – (1) achieving universal and equitable access to safe and affordable drinking water for all, (2) achieving access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations, (3) improving water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally, (4) substantial increasing water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity, (5) implementing integrated water resources management at all levels, including through transboundary cooperation as appropriate, (6), protecting and restoring water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes, (7) expanding international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies, and (8) supporting and strengthening the participation of local communities in improving water and sanitation management.

2. Restoration missions and actions with positive results

The EU Mission Restore our Ocean and Waters[12] by 2030 aims to achieve the marine and freshwater targets of the European Green Deal including especially the (1) protection of 30% of the EU's sea area and restoring marine eco-systems, (2) getting 25,000 km of free-flowing rivers, (3) preventing and eliminating pollution by, for example, reducing plastic litter at sea, nutrient losses and use of chemical pesticides by 50% and (4) contributing to make the blue economy climate-neutral and circular with net-zero maritime emissions. As supporting measures for these objectives, the cross-cutting enabling actions should be included, in particular, broad public mobilization and engagement and a digital ocean and water knowledge system, known as Digital Twin Ocean.

[9] https://ec.europa.eu/environment/strategy/zero-pollution-action-plan_pl
[10] https://ec.europa.eu/commission/presscorner/detail/en/IP_21_2711
[11] https://sdgs.un.org/2030agenda
[12] https://ec.europa.eu/info/research-and-innovation/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/eu-missions-horizon-europe/healthy-oceans-seas-coastal-and-inland-waters_en

As an example, one of the most important actions is: Restoration activities on the Danube River: the need for international planning (Fig. 9). In this action it is proposed to create Danube river basin lighthouse which means “hubs and platforms supporting the development and deployment of transformative innovative solutions in all forms – technological, social, business, governance, ensuring fast progress towards the achievement of Mission objectives and important impact on society in the river and sea basins through science (what is known?) and technology (how do this?)”. An important tool is a network joined with integration, communication, monitoring, contribution, relevant actions, responsibilities within each activity.

Building on and bringing together existing governance structures, water polices, networks and relevant existing activities can be served to:

a) identification of Research and Innovation needs at basin level;
b) liaising with the ocean, marine and freshwater knowledge system and support sharing of observation data, information and computing toolboxes;
c) disseminating and raising awareness about suitable innovative solutions to address these needs;
d) organizing the demonstration and testing activities for the innovative solutions;
e) supporting access to finance and mobilizing suitable investors, through e.g.: pitching events, networks of investors, venture capital funds, local Entrepreneurial Discovery processes, etc.;
f) supporting the knowledge and technology transfer, including through training and skill development;
g) supporting cooperation of lighthouse projects with ‘associated regions”.

Figure 9: **Danube river basin and river networks**

Source: https://www.eea.europa.eu/data-and-maps/figures/restoration-activities-on-the-danube

Threats

The main weaknesses for the BIOEAST macro-region include primarily:

1. Political instability, lack of coordination and cooperation within pursuit of a common goal.
2. Financial crisis (e.g. lack of funds), land proprietary, technical, legal and natural conditions issues as reasons for non-implementation of measures.
3. Ecological flows that have not been derived for the relevant water bodies.
4. Changes in environmental variables:
   a) the risks from pollution (from agricultural and non-agricultural sources) with chemical substances leading to failure to achieve good ecological status/potential and chemical status of surface water bodies and chemical status of groundwater bodies which involve: atmospheric deposition and discharges from urban waste water treatment plants as the main pressures for surface waters, and the nitrates as predominant pollutants throughout the EU, followed by pesticides, salt intrusion (e.g. chloride), some chemicals used industrially (e.g. tetrachloroethylene) and/or metals (e.g. arsenic, nickel and lead) for groundwater;
   b) climate change and environmental degradation confirmed as an existential threat to Europe and the world where agriculture plays the role of the most important pressure, and pollution from contaminated sites or abandoned industrial sites and discharges that are not connected to a sewerage system;
   c) priority substances including selected existing chemicals, plant protection products, biocides, metals and other groups like Polyaromatic Hydrocarbons (PAH) that are mainly incineration by-products and Polybrominated Biphenylethers (PBDE) that are used as flame retardants.

2.4. Recommendations

Commission recommendations on the second RBMPs and first FRMPs were provided in European Commission report from 2019[13], and they were synthesized in ANNEX 3.

Recommendations should be multifaced and region-specific with concern of the main solutions such as:

1. Establishment of Flood Risk Management Plans as integrated sub-plans to River Basin Management Plans.
2. Implementation of new solutions based on the new EU Strategy on Adaptation to Climate Change[14], including especially recommendations of European Commission for:
   a) nature-based solutions essential for sustaining healthy water, oceans and soils, which must play a bigger role in the land-use management and infrastructure planning to reduce costs, provide climate-resilient services, and improve compliance with WFD requirements for good ecological status; in case of inland waters the nature-based solutions (with restoration of the sponge-like function of soils) will boost the supply of clean, fresh water and reduce risk of flooding; in case of coastal and marine areas, nature-based solutions will enhance coastal protection and reduce risk of algal blooms; and simultaneously, they will provide benefits such as carbon sequestration, tourism opportunities, and biodiversity conservation and restoration;

[13] European Commission 2019. REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL on the implementation of the Water Framework Directive (2000/60/EC) and the Floods Directive (2007/60/EC), Second River Basin Management Plans, First Flood Risk Management Plans. Brussels, 26.2.2019, COM(2019) 95 final and ANNEX
[14] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021DC0082&from=EN

b) focusing attention on developing and rolling out physical solutions, to help in reducing climate risk, increasing climate protection, and safeguarding the freshwater access by creating more green spaces to reduce the impacts of heatwaves or adjusting sewerage systems to better cope with storm overflows;
c) ensuring that freshwater is available in a sustainable manner and fundamental for climate resilience, thus, smart and sustainable water use requires transformational changes in all sectors with prioritizing this through the enhanced engagement of the Common Implementation Strategy of the Water Framework and Floods Directives;
d) nature-based solutions which particularly well suited for climate resilience to water impacts, and climate changes exacerbates the challenge of sharing water resources and requires closer cooperation between adaptation action and water management authorities, including across borders;
e) sharply reducing water use, promoting a wider use of drought management plans, measures to increase the water retention capacity of soils and safe water reuse, improving water efficiency and reuse by raising the requirements for products subject to eco-design and energy labelling, energy production, housing and buildings, and agriculture and improving water savings in industrial plants, promoting the transition to water-saving technologies and practices by setting a price that correctly reflects the value of water;
f) promoting instruments such as water resource allocation, water-permitting systems and incorporating environmental externalities, i.e. in agriculture, a knowledge-based approach, as well as both high tech and nature-based solutions are necessary to ensure a sustainable use of water including the support of precision farming via national Common Agricultural Policy Strategic Plans;
g) ensuring water quality and preserving sufficient water quantities for healthy environment and for all people to guarantee a stable and secure supply of drinking water; maximizing the capacity of soils to purify water and reduce pollution,
h) preventing the risk of contamination and acute pollution of freshwater due to impacts such as low river flows, increased water temperatures, flooding, and forest loss which is important to include climate impacts in the risk analyses of (drinking) water management plans, develop water-monitoring technologies, and ensure minimum river flow.

3. Implementation of an ecosystem-based approach[15] - navigating the course towards clean, healthy and productive seas with the conclusions for current situation of water bodies in Europe: "Our environment, our natural jewels, our seas and oceans, must be conserved and protected." Ursula von der Leyen, Political guidelines for the next European Commission 2019-2024, 9 October 2019, EEA Report No 17/2019 with key messages the future of our seas that:
   a) marine ecosystem condition is directly linked to the combined effects of multiple pressures from the human use of Europe's seas and with a way of identifying the limits for the sustainable use of our seas;
   b) the EU has not managed to decouple the use of Europe's seas from marine ecosystem degradation, and the way that we use the natural capital held in our seas does not appear to be sustainable, as already concluded in the EEA's 2015 report State of Europe's seas;
   c) the EU still has a chance to restore some marine ecosystem resilience piece by piece, which would increase resilience to the climate crisis and to other pressures; although there is an urgent need to act now;

[15] https://www.eea.europa.eu/publications/marine-messages-2

d) past EU and regional policy implementation allows the identification of a set of lessons for restoring marine ecosystems, which should be used when coming up with actions and solutions to achieve clean, healthy and productive seas; general actions to do so are (1) closing the implementation and knowledge gaps, and (2) steering policy implementation towards operationalizing ecosystem-based management;
e) several solutions for halting the loss of marine biodiversity and starting to restore some marine ecosystem resilience, while allowing for the sustainable use of Europe's seas, are obvious and readily available under the umbrella of these general actions; they just need to be implemented, and these solutions would also support making the ecosystem-based management of Europe's seas more operational;
f) moving towards a 'good condition' for Europe's seas is feasible within the existing EU policy framework by 2030 with political resolve, increasing coordination among stakeholders and policy integration; this needs to start by reducing pressures on marine ecosystems.

4. Implementation of the environmental DNA (eDNA) based methods in biodiversity monitoring, conservation and ecological status assessment for quick practitioners' adaption[16] [17] [18] [19] as supporting tools; the investigations showed that the eDNA technique can be applicable in (1) early detection of invasive species, (2) species detection for conservation, (3) community-level biodiversity monitoring, (4) ecosystem health monitoring, (5) study on trophic interactions, (6) reflecting the ecological status through a season-dependent eDNA, (7) improving the timeliness of bioassessment, etc. However, the methods and protocols[20] [21] utilized for eDNA metabarcoding should be standardized and improved due to their robustness, comparability and use within regulatory frameworks. It is expected that the latest and future developments especially for benthic communities will continue to produce the new eDNA-based tools that will collectively revolutionize the field of biomonitoring. Some positive case studies[22] [23] [24] concerned primarily the investigation driven by the need to develop reliable and cost-effective lake fish assessments to meet the requirements of the Water Framework Directive and other international and national environmental legislation. However, the standardization of eDNA methods and translation into legislatory framework remain still at a very early stage. These methods could be used in the future as "safe to use" only if they provide the same or almost same results as the conventional methods[25]. The needs to be ensured in the future were presented in Figure 10. All studies on eDNA were taken to improve eDNA methodology at every step of the workflow from sampling to data analysis, and they contribute to better understand the biological and technical factors impacting the eDNA analyses. Despite this huge new knowledge and numerous practical advantages, the implementation of eDNA in routine biomonitoring still has not taken off. In order to foresee and stimulate a harmonised implementation of eDNA, the European network DNAqua-Net (COST Action CA15219) was created between members of DNAqua-Net, members of ECOSTAT and other environmental biomonitoring stakeholders from different European 18 countries including only Hungary from the whole BIOAEST macro-region[26].

[16] https://doi.org/10.3390/biology10121223
[17] https://doi.org/10.1016/j.scitotenv.2021.151783
[18] https://doi.org/10.1002/edn3.178
[19] https://doi.org/10.1016/j.envint.2019.105230
[20] https://doi.org/10.1016/j.scitotenv.2021.151783
[21] https://ednasociety.org/en/manual
[22] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/575833/A_DNA_based_monitoring_method_for_fish_in_lakes_-_report.pdf
[23] https://www.ceh.ac.uk/sites/default/files/Cumbrian-lakes-forum-2020-Haenfling.pdf
[24] https://doi.org/10.1111/jfb.14176
[25] https://doi.org/10.1111/mec.16023
[26] https://doi.org/10.15454/29LFIW

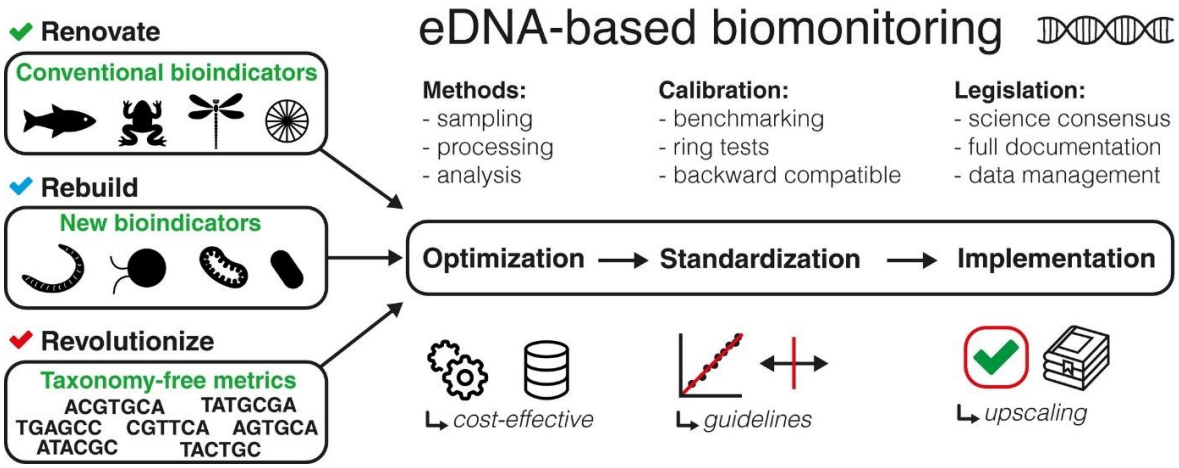

Figure 10: **Framework for an eDNA-based biomonitoring**

Source: Pawlowski et al. 2021 https://doi.org/10.1111/mec.16023

3. Networking potential in each BIOEAST country

Networking potential include the main institutions and leaders with their responsibilities and contact info, the areas of networking for each BIOEAST country (ANNEX 4). Generally, the Competent Authorities include central level: ministries responsible for environment, water, agriculture, food, health, energy, forestry, regional development and public works, interior, as well as water authorities named depending on each country. On the regional level, the responsibilities belong to regional authorities (e.g. Regional Water Management Boards) whereas on local level there were local authorities such as municipal authorities and district offices including energy/hydropower, local/regional authorities, NGOs/nature protection and public authorities responsible for public and environmental health, amelioration systems of national interest and planning of investments. The establishment of advisory groups was used for the active involvement of stakeholders.

In the future, the networking potential could be expanded to cooperation across scientific disciplines, businesses and citizens as important groups.

Actually, the European Union focuses on “The EU Mission Restore our Oceans and Waters by 2030” within four Mission lighthouses (Figure 11 A, B):

1. The Baltic Sea/The North Sea: Platform and actions on reducing maritime emissions, zero carbon aquaculture, carbon neutral multipurpose use of maritime space;
2. The Atlantic and Arctic: Platform and actions for restoration and coastal resilience;
3. Danube River basin: Platform and actions for river basin restoration;
4. Mediterranean: Platform and actions on pollution (plastics, nutrient and chemicals).

A)

B)

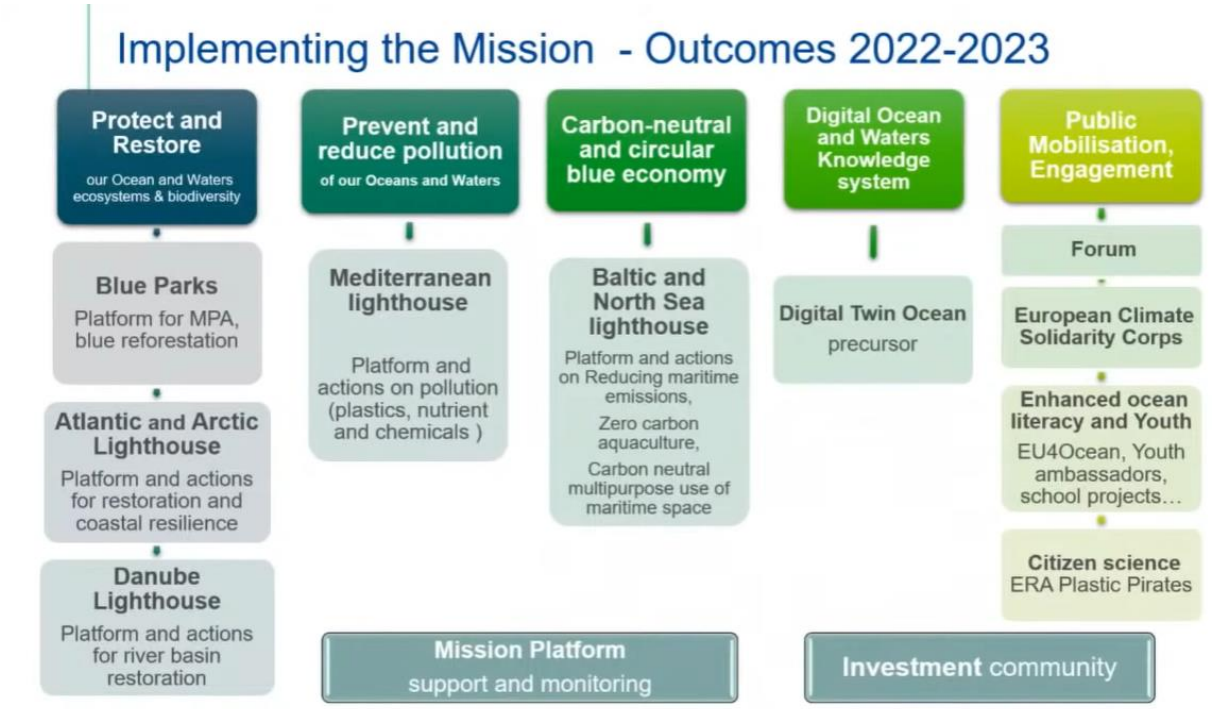

Figure 11: **The Mission lighthouses (A) and their implementing (B) within EU Mission Restore our Oceans and Waters by 2030.**

Source: https://www.youtube.com/watch?v=kETGb6tNWFw

The EU Missions are part of the Horizon Europe research and innovation programme for 2021-2027 aiming to address some of the greatest challenges facing our society. The objectives of Mission 'Restore our ocean and waters by 2030' is to provide a systemic approach for the restoration of our oceans, seas and waters by 2030. The specific objectives of the Mission are interlinked and mutually supportive to: (1) protect and restore marine and freshwaters ecosystems and biodiversity in line with EU Biodiversity Strategy 2030, (2) prevent and eliminate pollution of our oceans, seas and waters in line with the EU Action Plan Towards Zero Pollution for Air, Water and Soil, and (3) make the blue economy carbon-neutral and circular in line with the European Climate Law and the holistic vision supported by the Sustainable Blue Economy Strategy. These Missions should deliver concrete results by 2030. The main two enablers include: (1) Digital Ocean and Waters Knowledge system, (2) Public Mobilization and Engagement. The planned governance of the EU Missions was presented during last webinar on the EU Mission Restore our Ocean and Waters by 2030[27] (Figure 12).

[27] https://www.youtube.com/watch?v=WtLPszuEA1g

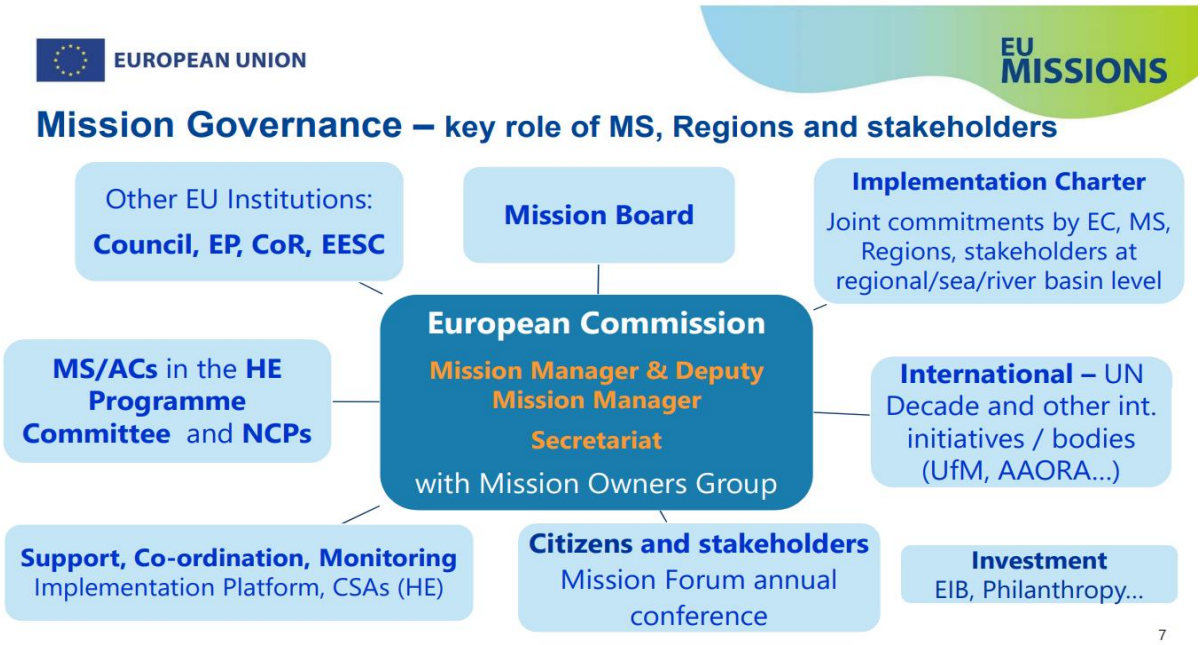

Figure 12: **The planned networking potential for the EU Missions governance**

Source: https://www.youtube.com/watch?v=WtLPszuEA1g

Projects, networks and final products related to EU Missions – examples

1. The international multi-partner (especially from Western European and Scandinavian countries plus Estonia) project BlueHealth (Linking environment, climate & health) project – a pan-European research investigation linking health and urban blue space has increased understanding of how urban blue spaces can affect people's wellbeing. This project started in January 2016 and finished in December 2020[28]. As the final products were primarily: BlueHealth Behavioural Assessment Tool (BBAT) has been designed to capture the activities that people take part in, at a particular blue space[29] and BlueHealth Environmental Assessment Tool (BEAT) to provide places where people can enjoy access to water and also obtain many of the health and well-being benefits associated with such blue spaces[30].
2. The international multi-partner project (11 European countries including Poland as one of the BIOEAST region) AMBER, i.e. Adaptive Management of Barriers in European Rivers[31] (realized in 2016-2020) project was to create an inventory of barriers within European rivers— a Pan-European Atlas of In-Stream Barriers. It sought to apply adaptive management to the operation of barriers in European rivers to achieve a more effective and efficient restoration of stream connectivity. The project results were introduced into EU Biodiversity Strategy for 2030 as a goal of Restoring at least 25 000 km of EU rivers to a free flowing state. Furthermore, as final products were (1) AMBER BARRIER ATLAS, i.e. the first European map of river barriers[32], AMBER River Infrastructure Planning (RIP) tool, Mesohabitat Simulation Model, Rapid Barrier Passability and Hydropower Assessment Tool, Barrier Tracker, and studies on eDNA metabarcoding as a sensitive technique to monitor the effects of barrier removal for the fish community composition.

[28] https://bluehealth2020.eu/research/
[29] BlueHealth Behaviour Assessment Tool – BBAT
[30] https://www.beat.bluehealth.tools/
[31] https://amber.international/
[32] https://amber.international/european-barrier-atlas/

3. MissionSea 2030 – Mission Latvia aims to create global scale platform for rapid innovations up to (1) act together for the common good of global society while understanding its effect on the economic triple bottom line, and (2) accelerate testing, piloting and implementation of innovative policies and sustainable practices with the aim to create environment and instruments for restoring nature resources - “giving back to nature”. All activities are based on fast-growing tech industries, tackling urgent economic, climate, societal challenges by implementing an ambitious mission.

A collaborative initiative in developing a high precision virtual model for a healthy Baltic Sea - Baltic Sea digital twin which is expected to provide a simulated environment where it will be possible to model the effects that human activity has on the sea, especially to combat the effects of climate change under the name of Mission Sea 2030. The aim is to foster the cooperation between industries and implement new solutions that would fuel economic growth and ensure the natural regeneration of the sea. The Baltic Sea’s digital twin will be a meaningful component to accomplishing Mission Sea 2030, using the latest technology to identify, model, and monitor the sea ecosystem[33].

Promising areas and instruments for the cooperation

Relevant policies and instruments include available funding, in particular the European Union funds (e.g. Rural Development Programmes - RDP funds, Structural and Investment funds, LIFE Integrated Projects and Horizon Europe).

The relevant regulations from Nitrates Directive, Habitat and Birds Directive related Protected Areas, EU Biodiversity Strategy for 2030, European Green Deal and Farm to Fork and Biodiversity strategy, Towards zero air, water and soil pollution, Common Agricultural Policy, Transforming our world: the 2030 Agenda for Sustainable Development should be priority for any activities in the river basins within BIOEAST region.

Through the European Green Deal a water resilience agenda has started to emerge, with attention to water efficiency in various legislative reviews and in horizontal strategies such as the Circular Economy Action Plan and EU Climate Adaptation Strategy.

The promising instruments should include steering policy implementation towards operationalizing ecosystem-based management using the cooperation at various geographical scales. i.e. on international level concerning also macro-regional level, national level with central authorities, regional authorities and local authorities. Such cooperation should also be maintained across scientific disciplines, businesses and countries, and with citizen's is what works to reverse marine ecosystem degradation. This includes increasing the public's 'ocean literacy'. Policy visions for healthy, clean and productive seas need to be better aligned with expectations for the exploitation of marine, freshwater and terrestrial resources. Full integration within and across all policies using natural capital would better support the maintenance of marine ecosystem capital and the sustained supply of ecosystem services.

A conceptual model of further activities to ensure “a heritage which must be protected, defended and treated as such” (WFD, 2000/60/EC) should include:
1. Population health and wellbeing.
2. Communication, coordination and activities.
3. Quantity and quality of water bodies.
4. Urban planning and infrastructure relevant to water body management.

Mitigation climate changes and extreme events.

[33] https://www.smartcitiesworld.net/news/baltic-sea-digital-twin-to-be-developed-by-latvia-7177

4. Conclusion

The majority of BIOEAST water bodies has worse than good status, thus, a further acceleration of action by Member States is urgently needed. The European Green Deal as a unique opportunity should be seized by Member States and stakeholder groups to secure a water-resilient future. In brief:

1. The key actions like monitoring, measuring, assessing, controlling, limiting, and financing are recommend to be still improved in each BIOEAST country.
2. Proper water management and responsibility on international and national scales as well as on central, regional and local scales are of a high priority in the water policy.
3. There are still problems with drivers, pressures and pollutants including priority substances, and a clear link between agricultural pressures and agricultural measures in each country.
4. Implementation of horizontal strategies such as the Circular Economy Action Plan, EU Climate Adaptation Strategy, EU Biodiversity Strategy for 2030, European Green Deal and Farm to Fork and Biodiversity strategy, Towards zero air, water and soil pollution, Common Agricultural Policy, Transforming our world: the 2030 Agenda for Sustainable Development compliance with the provisions of the directives: Nitrates Directive, Habitat and Birds Directive and establishment of related Protected Areas.
5. Implementation of water-friendly modelling and actions in an innovative scale with a legal support are expected.
6. The cost-effective and less time-consuming methods in water quality monitoring, e.g. based on eDNA should be still developed due to lack of their standardization and legislation.

5. Annex

5.1. List of Annexes

Annex 1: **The questionnaire for international respondents**

QUESTIONS:

1. What is the current situation of the ecological status/potential and chemical status of surface water bodies, and chemical and quantitative status of groundwater in your country?
2. What are the responsibilities for ecological and chemical status of water bodies?
3. What instruments are implemented in your country?
4. What political, economic and legal barriers are evidenced in your country?
5. What main threats to surface waters and groundwater have been identified in your country?
6. What in your opinion should be included in the implementation plan to maintain at least good status of waters?

Annex 2: **SWOT analysis for each BIOEAST country**

Country	STRENGTHS	WEAKNESS	OPPORTUNITY	THREATS
Bulgaria[1]	1. Governance and public consultation 2. Improvement in defining pressures on surface water bodies: relations 'driving force-pressure-status-impact', enlargement the analysis of pressures and implement results from models, projects and research	1. Methodological gaps in monitoring, assessment, classifications; some national methodologies are missing. 2. Lack of complete monitoring of groundwater and all substances causing risk 3. Water quantity-related problems 4. Pollution sources - gap assessment for diffuse pollutant loads	1. Relevant policies and instruments (e.g. Rural Development Programme, CAP Pillar 1, ND etc.) 2. Groundwater Protected Areas designated under the Birds and Habitats Directives	1. Point and diffuse pollution sources, physical/ hydromorphological alterations, climate change, invasive species, fisheries, dredging and ports, navigation 2. Pollutants from agricultural and non-agricultural sources 3. The probabilities and the financial risks to not achieving WFD goals
Croatia[2]	1. Governance and public consultation 2. Active involvement of stakeholder groups 3. Complete classification of surface water bodies 4. All WFD core parameters are monitored	1. Methodological gaps in monitoring of quality elements, pollutant identification, assessment and classification. 2. Lack of proper classification of status/potential according to the hydromorphological biological quality elements. 3. Lack of complete defining, monitoring of all water bodies (without terrestrial waters)	1. New legislation and/or regulations 2. Safeguard zones for abstractions legally established 3. Consideration of Natural Water Retention Measures 4. Climate Change Adaptation Strategy	1. Pollutants from agricultural and non-agricultural sources 2. Soil erosion 3. Lack of polluter pays principle application 4. Climate changes, climate warnings, droughts,

Country	STRENGTHS	WEAKNESS	OPPORTUNITY	THREATS
		4. Situation on water quality is still unknown for a number of water bodies. 5. Significant number of pressures. 6. The number of water bodies failing to achieve good status as a result of pollution from Priority Substances		
Czech Republic[3]	1. International monitoring network of a river convention 2. Active engagement of stakeholders	1. Lack of type-specific reference conditions for all water type and hydromorphological quality elements 2. Many cases with unknown significant anthropogenic pressures 3. Gaps in the apportionment of pressures, methodology and intercalibration 4. Not all quality elements were monitored (e.g. priority substances)	1. New legislation and/or regulations 2. Commission for Water Planning, supports coordination and harmonization 3. The new European Union funding policy and significant contribution of all relevant policies and instruments (e.g. RDP, CAP Pillar 1, ND etc.)	1. Pollutants from agricultural and non-agricultural sources 2. Financial (e.g. lack of funds), land proprietary, technical, legal and natural conditions issues as reasons for non-implementation of measures
Estonia[4]	1. Active involvement of stakeholder groups 2. International cooperation 3. Cost-Effectiveness analysis has been introduced	1. High proportion of “unknown” pressures 2. Significant gaps in the quality elements monitored for surveillance purposes 3. Lack of complete monitoring of River Basin Specific Pollutants (prevalence of expert judgment) 4. Not complete monitoring of each water category 5. Lack of clear criteria for the application of "technical feasibility", "disproportionate costs" and "natural conditions"	1. Positive legislations e.g. established general binding rules to control diffuse pollution and mandatory safeguard zones around protection areas that are used or intended to be used for drinking water 2. Protected areas 3. Common Implementation Strategy guidance document on how to adapt to climate change, and Drought Management Plans (to develop)	1. Pollutants from agricultural (a clear link between agricultural pressures and agricultural measures) and non-agricultural sources.
Hungary[5]	1. Active engagement of various stakeholders	1. Inadequacies in the methodologies used to assess pressures (unknown	1. New legislation and/or regulations 2. Establishment of safeguard zones, buffer	1. A clear link between agricultural pressures and agricultural measures 2. Climate change

Country	STRENGTHS	WEAKNESS	OPPORTUNITY	THREATS
	2. Almost complete assessment methods, classifications, and intercalibration of biological quality elements (except fish)	anthropogenic) and impacts pressures on lakes, and gaps for most significant pressures 2. Hydromorphological quality elements classified mainly using expert judgement, indicating weaknesses in the current methodology 3. Failure to meet the objectives of the WFD for most surface water bodies (90%) – expectations to achieve good status only after 2027 4. No clear distinction between droughts and water scarcity. 5. Lack of drought management plan	zones 3. Natural Water Retention Measures with high priority in Hungary	
Latvia[6]	1. Joint consultation for the River Basin Management Plans and Flood Risk Management Plans and active involvement of stakeholders including via advisory groups 2. Natural water retention and green infrastructure measures	1. A high proportion of pressures reported for surface waters which were reported as “unknown”, particularly for coastal and transitional water bodies 2. Priority Substances causing failure of chemical status 3. Significant gaps in the quality elements monitored, monitoring of water bodies (e.g. groundwater bodies, territorial waters), methodology, assessment, sampling frequencies 4. Assessment of significant adverse effects is still done on a case-by-case basis using expert judgement and without specific criteria	1. Natural Water Retention Measures 2. Flood Risk Management Plans and River Basin Management Plans in line with WFD objectives 3. New legislation or regulations 4. Safeguard zones have been established for abstractions	1. Impact of climate change 2. Drivers, pressures and impacts leading to exemptions are reported 3. Pressures responsible for Priority Substances pollution 4. There has been no co-ordination with the Floods Directive in any other aspect 5. A clear link between agricultural pressures and agricultural measures 6. Financing of agricultural measures is not secured in all basins. 7. Ecological flows have not been derived for the relevant water bodies
Lithuania[7]	The RBMPs were not reported on time, and have therefore not been included in the Commission's assessment.			

Country	STRENGTHS	WEAKNESS	OPPORTUNITY	THREATS
Poland[8]	1. International cooperation through river basin committees and via bilateral agreements 2. Active engagement of various stakeholders including via the establishment of advisory groups 3. Reference conditions had been established for all water body types in each category	1. Still many pressure types where expert judgment was used to define the significance of pressures 2. Significant share of "unknown anthropogenic pressures", "unknown impact" type and gaps in pressures at surface and ground waters level 3. Classifications based on expert judgement based on grouping (River Basin Specific Pollutants) 3. High share of water bodies failing to achieve good status 4. Territorial waters were neither monitored nor classified	1. Joint consultation of River Basin Management Plans and Flood Risk Management Plans 2. Controlled water abstraction in the frame of measures implemented at country level and linked to: drafting or verification of 'conditions for water use in water regions and river catchments', review of water permits, in-depth pressure analysis aimed at hydromorphological modifications and preparation of a national programme for surface water renaturalisation	1. River Basin Specific Pollutants – risk of failing their objectives due to emissions from wastewater, industry and agriculture
Romania[9]	1.Active involvement of stakeholder groups, public with media (World Water Day and Danube Day) 2. Typology revised and number of types harmonized 3. Good quantitative status of groundwater	1. Gaps in the biological quality element type-specific reference conditions 2. Lack of complete comparability assessment within the intercalibration process and intercalibration of all water body types 3. Gaps indicators for significant pressures to be filled to achieve the environmental objectives for most significant pressures 4. Gaps in the monitoring of required quality elements and assessment methods (e.g. for macrophytes and fish) 5. Lack of biological quality element assessment methods that are sensitive to chemical pollution, hydrological changes, acidification and saline intrusion in rivers	1. A catalogue of mitigation and restoration measures 2. New Legislation and regulations in water policy 3. An inter-ministerial working group for the reconstruction of wetlands along the Danube and the main tributaries as a measure to reduce the risk of floods and to implement green infrastructure and water retention 4. Specific objectives for Drinking Water Protected Areas and for shellfish production areas 5. Common Implementation Strategy Guidance Document No. 24 on how to adapt to climate change	1. Drivers, pressures and pollutants (waste water, nutrients, pesticides) 2. Agricultural and non-agricultural pollution sources, hydromorphological pressures 3. A lack of finance and mechanism, and delays in the tendering of contracts in the first Programme of Measures

Country	STRENGTHS	WEAKNESS	OPPORTUNITY	THREATS
		6. Lack of information on River Basin Specific Pollutants in surface water, and some Priority Substances causing surface water bodies to fail to be of good status 4. Ecological flows not in all		
Slovak Republic[10]	1. Involvement of stakeholder groups, media, schools 2. Significant increase for both surveillance and operational monitoring sites 3. All required biological, physico-chemical and hydromorphological quality elements were monitored in rivers	1. Lack of assessment of the linkages of groundwater bodies with surface water bodies and terrestrial ecosystems 2. High share of "unknown impact type" for river water bodies - potential gaps in the methodologies used to assess pressures and impacts 3. Lack of complete monitoring and classification based on quality elements of all water bodies 4. Classification with low confidence using expert judgement 5. Not entirely clear used Environmental Quality Standards 6. Gaps in the quantitative and chemical monitoring of groundwater 7. Ecological flows	1. Establishment of Flood Risk Management Plans as sub-plans to River Basin Management Plans 2. New legislation, regulations and financial politics 3. Habitat and Birds Directive related Protected Areas, Safeguard zones for the protection of Drinking Waters 4. Common Implementation Strategy guidance document on how to adapt to climate change was used. 5. Objectives of WFD, Floods Directive and Natural Water Retention Measures to tackle significant pressures	1. Point and diffuse pollution sources – agricultural and non-agricultural. 2. A clear link between agricultural pressures and agricultural measures 3. Priority substances
Slovenia[11]	1. Preparation of its RBMP via the international commissions for the Sava and Danube and also via bilateral commissions with neighbouring Member States 2. Improvement in the level of confidence in the classification of ecological status/potential and development of most methods	1. Gaps in the development of reference conditions, particularly for hydromorphological quality elements 2. The Priority Substances causing failure of good chemical status 3. Lack of complete monitoring and classification, especially of fish and hydromorphological (rivers and lakes), quantitative status of groundwater	1. Improvement of Programme of Measures	1. Drivers, pressures and pollutants 2. Priority substances 3. A clear link between agricultural pressures and agricultural measures 4. "Adaption to climate change" is not made operational to address any of the significant pressures and specific sub-plans on climate change aspects are not reported.

Country	STRENGTHS	WEAKNESS	OPPORTUNITY	THREATS
	3. All groundwater bodies (100%) are in good quantitative status	4. Weaknesses in the assessment method of hydrological regime and morphological conditions 5. Gaps in the standards established for general physicochemical quality elements in rivers and coastal waters, and biological quality elements by ecological potential assessment 6. No surveillance monitoring of oxygenation conditions in coastal waters		

[1] European Commission 2019. COMMISSION STAFF WORKING DOCUMENT Second River Basin Management Plans - Member State: Bulgaria. Accompanying the document REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL on the implementation of the Water Framework Directive (2000/60/EC) and the Floods Directive (2007/60/EC), Second River Basin Management Plans First Flood Risk Management Plans. Brussels, 26.2.2019 SWD(2019) 39 final.
[2] European Commission 2019. COMMISSION STAFF WORKING DOCUMENT Second River Basin Management Plans - Member State: Croatia. Accompanying the document. REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL on the implementation of the Water Framework Directive (2000/60/EC) and the Floods Directive (2007/60/EC) Second River Basin Management Plans First Flood Risk Management Plans, Brussels, 26.2.2019, SWD(2019) 43 final.
[3] European Commission 2019. COMMISSION STAFF WORKING DOCUMENT Second River Basin Management Plans - Member State: Czech Republic. Accompanying the document. REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL on the implementation of the Water Framework Directive (2000/60/EC) and the Floods Directive (2007/60/EC), Second River Basin Management Plans, First Flood Risk Management Plans Brussels, 26.2.2019, SWD(2019) 35 final.
[4] European Commission 2019. COMMISSION STAFF WORKING DOCUMENT, Second River Basin Management Plans - Member State: Estonia. Accompanying the document REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL on the implementation of the Water Framework Directive (2000/60/EC) and the Floods Directive (2007/60/EC), Second River Basin Management Plans, First Flood Risk Management Plans. Brussels, 26.2.2019, SWD(2019) 40 final.
[5] European Commission 2019. COMMISSION STAFF WORKING DOCUMENT Second River Basin Management Plans - Member State: Hungary. Accompanying the document REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL on the implementation of the Water Framework Directive (2000/60/EC) and the Floods Directive (2207/60/EC), Second River Basin Management Plans, First Flood Risk Management Plans, Brussels, 26.2.2019, SWD(2019) 45 final
[6] European Commission 2019. COMMISSION STAFF WORKING DOCUMENT Second River Basin Management Plans - Member State: Latvia Accompanying the document REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL on the implementation of the Water Framework Directive (2000/60/EC) and the Floods Directive (2007/60/EC). Brussels, 26.2.2019, SWD(2019) 49 final
[7] The RBMPs were not reported on time, and have therefore not been included in the Commission's assessment.
[8] European Commission 2019. COMMISSION STAFF WORKING DOCUMENT Second River Basin Management Plans – Member State: Poland. Accompanying the document REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL on the implementation of the Water Framework Directive (2000/60/EC) and the Floods Directive (2007/60/EC), Second River Basin Management Plans, First Flood Risk Management Plans. Brussels, 26.2.2019, SWD(2019) 53 final
[9] European Commission 2019.COMMISSION STAFF WORKING DOCUMENT Second River Basin Management Plans – Member State: Romania Accompanying the document REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL on the implementation of the Water Framework Directive (2000/60/EC) and the Floods Directive (2007/60/EC), Brussels, 26.2.2019, SWD(2019)52 final.
[10] European Commission 2019. COMMISSION STAFF WORKING DOCUMENT Second River Basin Management Plans – Member State: Slovakia. Accompanying the document REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL on the implementation of the Water Framework Directive (2000/60/EC) and the Floods Directive (2007/60/EC, Second River Basin Management Plans, First Flood Risk Management Plans. Brussels, 26.2.2019, SWD(2019) 54 final
[11] European Commission 2019. COMMISSION STAFF WORKING DOCUMENT Second River Basin Management Plans – Member State: Slovenia. Accompanying the document REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL on the implementation of the Water Framework Directive (2000/60/EC) and the Floods Directive (2007/60/EC), Second River Basin Management Plans, First Flood Risk Management Plans. Brussels, 26.2.2019, SWD(2019) 55 final
Source: WISE (Water Information System for Europe)

Main recommendations

BULGARIA – (1) improvement of international cooperation, including coordinated assessments of the technical aspects of the Water Framework Directive and a coordinated Programme of Measures; (2) harmonization of the assessment of agricultural and non-agricultural pressures and measures planned to mitigate their effect; (3) strengthening of monitoring and assessment methods, lowering dependence on expert judgment for the ecological and chemical classification, completing the development of assessment methods and selection of River Basin Specific Pollutants, reducing "unknown" status; (4) progress in the justification, determination the types of modifications and quantification of gaps; (5) a cost-effectiveness analysis and specific prioritization of measures; (6) completion a comprehensive gap assessment for diffuse pollutant loads from agriculture and non-agriculture linking it directly to mitigation measures and the inventories of emissions, by considering all Priority Substances and other substances; (7) coordination between water and agriculture departments in the review and development of the strategy for the delivery of WFD objectives; (8) establishing the ecological flows for all relevant water bodies, prioritizing the use of green infrastructure and/or natural water retention measures; (9) continuing the application of cost recovery for water use activities, work on groundwater Protected Areas designated under the Birds and Habitats Directives; (10) distinction of water scarcity and drought in water policy and elaborating Drought Management Plan, Water resource allocation and management plan.

CROATIA – (1) active involvement of stakeholders, (2) improvement of international cooperation including coordinated assessments of the technical aspects of the WFD such as ensuring a harmonized approach for status assessment and a coordinated Programme of Measures in order to ensure the timely achievement of the WFD objectives, (3) the identification of pressures, in particular in transitional and coastal waters, (4) general improvement in monitoring of water bodies to avoid important gaps, strengthen the methodology, lower dependence on expert judgment for the classification of ecological status/potential, designate Heavily Modified Water Bodies, define potential, reduce uncertainties, (5) cost-effectiveness analysis and specific prioritization, (6) abstraction controls, information on uses, water exploitation and use of natural water retention measures to mitigate risk to water quality, pollution risk mitigation, use of green infrastructure, proper monitoring of the Protected Areas, and a drought management plan establishment

CZECH REPUBLIC – (1) ensuring good coordination between the public administration and other stakeholders to improve the planning and implementation of Programmes of Measures and to monitor their effectiveness, and improving international cooperation; (2) strengthening of monitoring and improvement of WFD compliant assessment methods for all water body types and selection of River Basin Specific Pollutants; (3) completion of the improvement and subsequent application of the approach for the designation of Heavily Modified Water Body and the methodology for the definition of ecological potential; (4) clearly identifying and fulfilling any gaps in monitoring, methodology, and significant pressures (especially hydromorphological, Priority Substances, River Basin Specific Pollutants and significant abstraction pressures); (5) quantification of the basin-wide impact on ecological status of mitigation measures aimed at agricultural water pollution sources (nutrients, agri-chemicals, particulate matter); (6) continuation of: the works towards an ambitious approach to combat chemical pollution, reviewing and developing the strategy for the delivery of WFD objectives, the works on restoration of river continuity and methodology to define the ecological flows, prioritizing the use of green infrastructure and/or natural water retention measures and work on Protected Areas

ESTONIA – (1) improvement of international cooperation, including coordinated assessments of the technical aspects of the WFD; (2) completion in identification of pressures and their

apportionment among sectors, reference conditions for all relevant Quality Elements of all surface waters, and in inventories of emissions, discharges and losses of chemical substances; (3) improvement in monitoring, assessment and level of confidence of surface water bodies and groundwater bodies to ensure meeting WFD requirements; (4) development of Environmental Quality Standards for all River Basin Specific Pollutants, that meet the minimum requirements for the protection of freshwater and marine ecosystems from possible adverse effects, as well as of human health; (5) mitigation of pollution risk, limitation of nitrogen and phosphorus flows, tackling non-agricultural pollution; (6) establishing the ecological flows for all relevant water bodies, prioritizing the use of green infrastructure and/or natural water retention measures

HUNGARY – (1) improvement of international cooperation, including coordinated assessments of the technical aspects of the WFD and a coordinated Programme of Measures; (2) continuation of work in order to quantify the significant pressures on surface water bodies and completion the development of assessment methods for fish; (3) quantification of hydromorphological pressures, and less reliance on expert judgement in classification of hydromorphology; (4) improvement of the confidence in the assessment of status for all water categories reducing the proportion in unknown status; (5) strengthening monitoring for chemical status of groundwater to reduce uncertainties and support the Programme of Measures; (6) identifying and taking effective measures against chemical pollutants in surface and groundwaters; (7) a clear distinction between water scarcity and drought in water policy and that a Drought Management Plan should be adopted; (8) continuation of transparently present the water-pricing policy, providing an overview of estimated investments and investment needs; (9) implementation of thorough monitoring programmes for relevant Protected Areas and setting additional objectives and measures.

LATVIA – (1) providing clear information in national plans on international coordination efforts, in order to increase transparency; (2) improvement of international cooperation, including coordinated assessments of the technical aspects of the WFD and coordinated Programmes of Measures; (3) consideration of diffuse sources in the next inventories; (4) continuation of the work on the delineation of water bodies, further work on the analysis and identification of pressure; (5) identification of sources of funding, as appropriate, to facilitate implementation of measures to contribute to achieving the WFD objectives; (6) continuation to improve monitoring of surface waters and a clear and transparent method for the selection of River Basin Specific Pollutants; (7) completion of the development of assessment methods and reducing the proportion of water bodies with unknown status, reducing uncertainty and to establish more thorough, transparent and improved justifications; (8) defining and implementation of hydromorphological measures in all RBDs; (9) improving its assessment of the likely effectiveness of measures against nonagricultural sources of pollution.

POLAND – (1) Clear information should be included in national RBMPs on international coordination efforts; (2) continuation to improve international cooperation, including coordinated assessments of the technical aspects of the WFD such as ensuring a harmonized approach for status assessment and a coordinated PoM; (3) work on the significance of pressures and on clarifying impacts, monitoring, assessment and classification of groundwater status fully compliant with the requirements of the Groundwater Directive; (4) strengthen monitoring of surface water, increased level of monitoring should lead to a lower dependence on expert judgment and on grouping for the classification of ecological status/potential, and consequently to an increased confidence in the assessment of ecological status; (5) completion of assessment of ecological status for all categories of water, continuation of progress in the transfer of

the results of intercalibration into all national types and increase of confidence in the assessment of status; (6) improving the trend monitoring to ensure that all the relevant substances specified in Directive 2008/105/EC are monitored, and developing a consistent methodology for the designation of heavily modified water bodies; (7) d completion of comprehensive gap assessment for diffuse pollutant loads from agriculture (nutrients, agri-chemicals, sediment, organic matter).

ROMANIA – (1) improving international cooperation, including coordinated assessments of the technical aspects of the WFD such as ensuring a harmonized approach for status assessment and a coordinated PoM; (2) further work on setting reference conditions, and the apportionment of pressures among sector; (3) further strengthen monitoring of surface water by covering all relevant quality elements in all water categories, including hydromorphological quality elements, and completion the development of assessment methods for all relevant quality elements and ensure that they are according to the WFD requirements; (4) further improvement of the confidence in the assessment of chemical status, trend monitoring in sediment and/or biota, quantitative and chemical groundwater monitoring, the methodology for defining ecological potential for all water categories at water body level, the implementation of the requirements under the Urban Waste Water Treatment Directive and specific measures in its safeguard zones associated to Drinking Water Protected Areas; (5) ensuring e.g. that ecological flows are derived and implemented, the identification of all relevant hydromorphological pressures and implement appropriate measures to address those pressures; (6) continuation of monitoring the efficacy of measures, applying the cost recovery for water use activities having a significant impact on water bodies or justify any exemptions.

SLOVAK REPUBLIC – (1) improvement of international cooperation, including coordinated assessments of the technical aspects of the WFD and a coordinated Programme of Measures; (2) establishment of reference conditions for all types of Quality Elements, in particular hydromorphological Quality Elements; (3) completion and improvement of monitoring due to still existing important gaps and low level of confidence in the classification of ecological status/potential; (4) completion in development of assessment methods, including reference conditions, for all relevant quality elements and improvement of the confidence in the assessment and trend monitoring; (5) improvement the designation process of heavily modified and artificial water bodies; (6) gap analysis for pressure on groundwater, mapping River Specific Basin Pollutants and Priority Substances, abstraction and point sources; (7) continuation works on hydromorphological pressures and to ensure restoration of water bodies; (8) implementation of ecological flows and consideration of river restoration with prioritising the use of green infrastructure and/or natural water retention measures; (9) continuation of work on setting specific additional objectives for all Protected Areas under relevant Directives

SLOVENIA – (1) Clear information should be included in national RBMPs on international coordination efforts in order to increase transparency; (2) further strengthen bilateral cooperation with neighbouring countries and continue to improve international cooperation, including coordinated assessments of the technical aspects of the WFD such as ensuring a harmonized approach for status assessment and a coordinated PoM; (3) continuing the works: on reference conditions and improving the monitoring of surface waters by covering all relevant quality elements in all water categories, improving the confidence in the assessment of status, in particular by making sure the spatial coverage of monitoring in biota is sufficient, consideration of river restoration and prioritise the use of green infrastructure and/or natural water retention measures, and on applying cost recovery for water use activities having a significant impact on water bodies or justify any exemptions; (4) completion of review of significant pressures and impacts, in particular to reduce the significant number of pressures currently reported as

"anthropogenic pressure – unknown", the development of assessment methods for all relevant biological quality elements in all water categories, (5) reporting the information on trend monitoring of pentachlorobenzene as part of the third RBMPs, and should carry out trend monitoring in lakes in the Adriatic RBD; (6) developing a clear and transparent methodology for the designation of heavily modified water bodies; (7) ensuring a thorough assessment of any potential planned new modifications in line with the requirements of the WFD and as further specified by the Judgment of the Court in case C-461/13, and the measures reported for individual substances causing failure are sufficient to reach the WFD objectives of good status; (8) ensuring the implementation of measures to address hydromorphological pressures; (9) adding the additional objectives related to the Habitat and Birds Directives, and preparing drought management plans where appropriate.

Annex 3: **European Commission recommendations on the second RBMPs and first FRMPs (EC 2019)[34]**

BULGARIA

1. Findings emerging from its 2nd RBMPs:
   a) Further improve international cooperation, by developing more harmonized approaches for assessing the status of shared water bodies and deliver better coordinated assessments and Programmes of Measures to ensure the timely achievement of the WFD objectives.
   b) Improve its own monitoring capacities with a view to lower its dependence on expert judgment for assessing the ecological status/potential of its water bodies.
   c) Base the use of exemptions under Article 4(7) on a thorough assessment of all the steps as required by the WFD and transparently indicate, in all RBDs, which are the justifications for invoking the exemptions under Article 4(7) WFD.
   d) Secure better compliance, especially in big cities, with Article 5 of the Urban Waste Water Treatment Directive, in relation to the requirement of more stringent treatment of wastewaters for discharge into sensitive areas.
   e) Provide a comprehensive gap assessment for diffuse pollutant loads from agriculture (nutrients, agri-chemicals, sediment, organic matter) across all waters in all its RBDs and link it directly to the proposed mitigation measures (as per Article 11(3)(h) WFD). These measures should be specific, have a clear legal basis and include appropriate monitoring and inspection regimes.
   f) Ensure that a clear distinction is made between water scarcity and drought in water policy and that a Drought Management Plan or a Water resource allocation and management plan is adopted.

2. Findings emerging from its 1st FRMPs:
   a) Improve the elaboration of objectives and measures by clearly indicating the timeline for achievement and implementation.
   b) Provide a more detailed description of the expected impacts of climate change on the occurrence of floods and ensure coordination with the National Climate Change Adaptation Strategy once adopted.

[34] European Commission 2019. REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL on the implementation of the Water Framework Directive (2000/60/EC) and the Floods Directive (2007/60/EC), Second River Basin Management Plans, First Flood Risk Management Plans. Brussels, 26.2.2019, COM(2019) 95 final; ANNEX to the REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND TO THE COUNCIL on the implementation of the Water Framework Directive (2000/60/EC) and Floods Directive (2007/60/EC), Second River Basin Management Plans, First Flood Risk Management Plans. Brussels, 26.2.2019, COM(2019) 95 final

c) Carry out, where relevant and based on a clearly explained methodology, cost-benefit analysis for the proposed measures and explain how this has led to the selection and prioritisation of those measures.

CROATIA

1. Findings emerging from its 2nd RBMPs:
   a) Step up work on the identification of pressures, in particular in transitional and coastal waters.
   b) Develop an appropriate methodology for the designation of Heavily Modified Water Bodies. The designation of HMWBs should comply with all the requirements of Article 4(3), and establish a methodology for defining ecological potential.
   c) Provide all relevant information on the level of compliance and the timing to reach compliance of agglomerations in accordance with Directive 91/271/EEC: Ensure also compliance with Article 5 UWWTD for more stringent treatment, especially in big cities.
   d) Consider additional measures on point source pollution beyond the requirements of the UWWTD and IED to fulfil the WFD objectives, and complete the identification of Key Types of Measures for diffuse sources.
   e) Ensure that abstraction controls are in place and that information on uses, water exploitation and trends is collected and reported; consider use of natural water retention measures to mitigate risk to water quality from agricultural pollutants, consider adopting Drought Management Plan(s) and continue revising existing controls to ensure that agricultural practices do not cause hydromorphological pressure and update controls where necessary.

2. Findings emerging from its 1st FRMPs:
   a) Present specific and measurable flood management objectives and clearly link measures to the objectives. Indicate the baseline against which progress can be monitored.
   b) Explain how the proposed measures are selected and prioritised, e.g. how the different factors influencing the choices made are weighted (including cost-benefit analysis, effectiveness and climate change).
   c) Provide further details on the approach to public consultation and the active involvement of stakeholders.

CZECH REPUBLIC

1. Findings emerging from its 2nd RBMPs:
   a) Secure better monitoring, in particular a sufficient number of water bodies and appropriate coverage of all relevant quality elements. Operational monitoring of lakes should be improved and better linked with the pressures and impacts analysis. Hydromorphological quality elements should be monitored in all water categories.
   b) Improve the reliability of the assessment of ecological status/potential and in particular, improve on assessment methods for hydromorphological elements, and link physico-chemical boundaries to the relevant biological quality elements in rivers.
   c) Provide better justification for the use of Article 4(4) and 4(5) exemptions; and distinguish clearly between these. This is particularly important as a significant number of water bodies are expected to achieve the WFD objectives only beyond 2027 and exemptions are widely applied.
   d) Quantify the reduction in pollutant load needed to achieve WFD objectives; the basin-wide impact of mitigation measures related to agricultural water pollution sources and

the extent to which the measures already taken under the ND and UWWTD contribute and identify additional measures to be taken to achieve fully the objectives.

e) Ensure the proper implementation of Article 9 on cost recovery, including the calculation and internalisation of environmental and resource costs.

2. Findings emerging from its 1st FRMPs:
   a) Develop measurable FRMP objectives and link the proposed measures to them, so as to be able to assess progress made.
   b) Provide a cost estimate for each measure and an overall budget for all measures, indicating whether it covers both investment and operational costs.
   c) Describe the method for the prioritisation of measures and provide clear information on the methods used to assess costs and benefits of measures.
   d) Ensure coordination with the National Climate Change Adaptation Strategy.

ESTONIA

1. Findings emerging from its 2nd RBMPs:
   a) Ensure that reference conditions are established for all relevant Quality Elements for all surface waters.
   b) Complete inventories of emissions, discharges and losses of chemical substances.
   c) Step up efforts to assess the status of all water bodies, increasing the confidence in the assessment of status and reducing the proportion of unknown status. Monitoring should provide sufficient temporal resolution and spatial coverage (including in biota).
   d) Better justify exemptions by developing and applying clear criteria for the application of Article 4(4) and distinguish these clearly from the criteria and justifications used under Article 4(5)

2. Findings emerging from its 1st FRMPs:
   a) Develop specific and measurable FRMP objectives and describe the process for setting objectives.
   b) Provide more detailed information on how much the implementation of measures would cost in each UoM and about their timetables. Provide also indicators of progress. Describe in the FRMPs the methodology used for cost-benefit analysis and present the results.

HUNGARY

1. Findings emerging from its 2nd RBMPs:
   a) Step up efforts to assess the status of all water bodies, increasing the confidence in the assessment of status and reducing the proportion of unknown status. Monitoring should provide sufficient temporal resolution and spatial coverage.
   b) All Priority Substances should be considered in the assessment of status, in the relevant matrix. If a different matrix is used, explanations should be provided.
   c) Tackle uncertainty in the designation of heavily modified and artificial water bodies through better monitoring, improved data on hydromorphological pressures and improved understanding of the effects on the biological quality elements. Ensure that the designation of HMWBs complies with all the requirements of Article 4(3).
   d) Ensure that abstractions are subject to effective permits, metering and controls.
   e) Ensure that a clear distinction is made between water scarcity and drought in water policy and that a Drought Management Plan is adopted

2. Findings emerging from its 1st FRMPs:
   a) Develop objectives that are more specific in terms of quantitative targets, locations and timeframes for achievement.
   b) Provide more clarity on the number of measures, the relationship between the FRMP's measures and other measures identified as preliminary and their prioritisation.
   c) Include an estimation of the cost of all measures in the next FRMP.
   d) Ensure coordination with the National Climate Change Adaptation Strategy.

LITHUANIA

1. Findings emerging from its 2nd RBMPs: The RBMPs were not reported on time, and have therefore not been included in the Commission's assessment.

2. Findings emerging from its 1st FRMPs:
   a) Clarify the legal status of the FRMP. Ensure that FRMPs, PFRAs/APSFRs, and FHRMs refer to each other as appropriate and that they are continuously available to all concerned and the public in an accessible format.
   b) Clearly link the proposed measures to the objectives, so as to be able to assess progress made.
   c) Dedicate space to climate change issues in the FRMPs and coordinate with the National Climate Change Adaptation Strategy.

LATVIA

1. 1. Findings emerging from its 2nd RBMPs:
   a) Identify sources of funding to facilitate the implementation of the WFD objectives.
   b) Complete the development of assessment methods for all biological quality elements. Methods for the assessment of the hydromorphological quality elements should be developed for transitional and coastal waters.
   c) Ensure that for potential future application of Article 4(7), a thorough assessment of possible new modifications is made.
   d) Ensure adequate co-ordination of the RBMPs with the Floods Directive and Flood Risk Management Plans.

2. 2. Findings emerging from its 1st FRMPs:
   a) To the extent possible, develop measurable FRMP objectives and link the proposed measures to them, so as to be able to assess progress made.
   b) Specify sources of funding for the measures.
   c) Present and apply a methodology for assessing measures in terms of costs and benefits where relevant and provide its results.
   d) Explain in the second cycle how the climate change impacts have been considered and ensure coordination with the National Climate Change Adaptation Strategy once adopted.

POLAND

1. Findings emerging from its 2nd RBMPs:
   a) Strengthen monitoring of surface waters by covering all relevant quality elements in all water categories.
   b) Provide a complete assessment of ecological status for all categories of water, including assessments of all relevant quality elements.
   c) Increase efforts to develop a consistent methodology for the designation of heavily modified water bodies for all relevant water categories.

d) Ensure that the use of exemptions under Article 4(7) is based on a thorough assessment of all the steps as required by the WFD.
e) Derive and implement ecological flows.

2. Findings emerging from its 1st FRMPs:
   a) Explain how the proposed measures are selected and prioritized, e.g. how the different factors influencing the choices made are weighted (including cost-benefit analysis, effectiveness and climate change).
   b) Consider conclusions from the finalized flood hazard and risk mapping of the 1st cycle for the 2nd cycle PFRA, FHRM and FRMP steps.
   c) Explain in the second cycle how the climate change impacts have been considered

ROMANIA

1. Findings emerging from its 2nd RBMPs:
   a) Work further on the apportionment of pressures among sectors.
   b) Strengthen monitoring of surface water by covering all relevant quality elements in all water categories, including hydromorphological quality elements and improve quantitative and chemical groundwater monitoring.
   c) Base use of exemptions under Article 4(7) on a thorough assessment of all the steps as required by the WFD.
   d) Improve the implementation of the requirements under the Urban Waste Water Treatment Directive in relation to the requirement of more stringent treatment of wastewaters for discharge into sensitive areas, and ensure investments to allow for appropriate treatment of waste water from big cities.

2. Findings emerging from its 1st FRMPs:
   a) Establish a stronger link between the objectives and measures and indicate whether planned measures, when completed, will be sufficient to achieve objectives.
   b) Provide cost estimates with a clear explanation of the sources of funding for the measures in the FRMPs.
   c) Explain how the proposed measures are selected and prioritised, e.g. how the different factors influencing the choices made are weighted (including cost-benefit analysis, effectiveness and climate change) and ensure coordination with the National Climate Change Adaptation Strategy.
   d) Ensure that FRMPs, APSFRs, and FHRMs refer to each other as appropriate and that they are continuously available to all concerned and the public in an accessible format, including digitally.

SLOVAK REPUBLIC

1. Findings emerging from its 2nd RBMPs:
   a) Establish reference conditions for all types of Quality Elements, in particular hydromorphological Quality Elements and improve the assessment of pressures and impacts.
   b) Complete the monitoring framework, needed to design effective Programmes of Measures.
   c) Treat measurements of Priority Substances lower than the limit of quantification in the way specified in Article 5 of Commission Directive 2009/90/EC.
   d) Base use of exemptions under Article 4(7) on a thorough assessment of all the steps as required by the WFD.

e) Ensure that measures reported for individual substances causing failure are sufficient to reach the WFD objectives. Implement and clearly report measures to suppress emissions from priority hazardous substances.

2. Findings emerging from its 1st FRMPs:
   a) Develop specific and measurable FRMP objectives, as well as links with measures that show how FRMP objectives will be achieved by the implementation of measures. A baseline should be defined.
   b) Present measures more clearly in the FRMPs.
   c) Strengthen the presentation of public consultation and stakeholder participation in the FRMP.

SLOVENIA

1. Findings emerging from its 2nd RBMPs:
   a) Continue to improve monitoring of surface waters by covering all relevant quality elements in all water categories and complete the development of assessment methods for all relevant biological quality elements in all water categories.
   b) Make a clear distinction between the designation of heavily modified water bodies and the application of exemptions. Base the use of exemptions under Article 4(7) on a thorough assessment of all the steps as required by the WFD.
   c) Ensure the implementation of measures to address hydromorphological pressures, if necessary by reviewing permits/concessions and allocating the necessary resources.

2. Findings emerging from its 1st FRMPs:
   a) Better explain and document the process for the development of objectives. Develop specific and measurable objectives, so their achievement can be ascertained;
   b) Present and explain in the FRMPs the baseline for implementation of the measures to be used in monitoring progress.
   c) Ensure that FRMPs, APSFRs, and FHRMs refer to each other as appropriate and that they are continuously available to all concerned and the public in an accessible format, including digitally. Present the results of the active involvement of stakeholders in the preparation of the FRMP and of public consultation in the FRMPs.
   d) Ensure coordination with the National Climate Change Adaptation Strategy.

Annex 4: **Main institutions and leaders, including the responsibilities and contact information**

Country	Main Institutions	Cooperation with European Environment Agency	National Contact
Bulgaria	**Responsible ministries/bodies** Central: 1. Ministry of Environment and Water 2. Ministry of Regional Development and Public Works 3. Ministry of Agriculture, Food and Forestry 4. Ministry of Energy 5. Ministry of Health 6. Executive Environment Agency Regional: 1. Regional Inspectorates for Environment and Water 2. National parks 3. River Basin Directorates and Basin Councils Local: 1. District Councils and District Governors 2. Municipal Councils and Mayors	Executive Environment Agency 136 Tzar Boris III blvd. P.O. Box 251 1618 Sofia Bulgaria Phone: +359 2 9559011 Fax: +359 2 9559015 Telex: +359 2 23894 e-mail: iaos@eea.government.bg Tanya Vladimirova Bulgarian Executive Environment Agency (BEEA) Valya Zhelyazkova Bulgarian Executive Environment Agency (BEEA) **Responsibilities:** The Ministry of Environment and Water is responsible for: co-ordination of implementation, economic analysis, enforcement of regulations, implementation of measures, reporting to the European Commission, and monitoring of groundwater and surface water, supporting role on public participation. Several other Ministries have main roles for the implementation of measures: Energy; Economy; Regional Development and Public Works;	Petya Balieva Ministry of Environment and Water 22 Princess Maria Luiza Blvd., Sofia 1000, Bulgaria Phone: +359 2 940 65 51 Fax: +359 2 981 52 71 e-mail: pbalieva@moew.government.bg Tsvetelina Ivanova (Protected areas expert in the MOEW - team member) Ministry of Environment and Water 22 Princess Maria Luiza Blvd., Sofia 1000, Bulgaria Phone: 00359 29 406 106 Fax: 00359 29 406 127 e-mail: tzvety@moew.government.bg Ivan Kalamerov (expert in Danube River Basin Directorate - team member) 60 Chataldja street, Pleven 5800, Bulgaria Phone: +359 64 885 100 Fax: +359 64 803 342 e-mail: ivan.kalamerov@bddr.org

Country	Main Institutions	Cooperation with European Environment Agency	National Contact
		Transport, Information Technology and Communications; and Agriculture and Food. Moreover, all these ministries have supporting roles for the enforcement of regulations, while the Ministry of Health also has supporting roles for the monitoring and assessment of status of surface water. Several national agencies are also identified. The Executive Agency for Exploration and Maintenance of the Danube River undertakes monitoring of surface water, as does the Institute of Oceanography. The Executive Environment Agency undertakes monitoring of groundwater and surface water, and so does the National Institute of Meteorology and Hydrology. The National Statistical Office carries out economic analysis. The Association ViK is also involved in the implementation of measures; so are municipalities in the RBDs (265 authorities).	https://www.moew.government.bg/
Croatia	**Responsible ministries/bodies** Central: 1. Ministry of Environmental Protection and Energy 2. Hrvatske vode (Croatian Waters) Regional: Regional authorities – counties (counties) Local: Local authorities (municipalities and cities)	Croatian Waters / Hrvatske vode Danko Biondic HRVATSKE VODE Ulica grada Vukovara 220, 10000 Zagreb, Croatia Phone: +385 1 6307 333 e-mail: voda@voda.hr https://www.voda.hr/en **Responsibilities:**	HRVATSKE VODE Ulica grada Vukovara 220, 10000 Zagreb, Croatia Phone: +385 1 6307 333 e-mail: voda@voda.hr

Country	Main Institutions	Cooperation with European Environment Agency	National Contact
		1. Croatian Waters / Hrvatske vode - the national body responsible for water management: the monitoring and assessment of groundwater and surface water; pressure and impact analysis; economic analysis; preparation of RBMP and Programme of Measures; reporting to the European Commission; and implementation of measures. Hrvatske vode has the following supplementary roles: public participation and co-ordination of implementation. 2. The main roles of the Ministry of Agriculture are enforcement of regulations, public participation and co-ordination of implementation; however, the Directorate for Water Management has recently moved from the Ministry of Agriculture to the Ministry of Environment and Energy, which should now hold these roles.	
Czech Republic	**Responsible ministries/bodies** <u>Central:</u> 1. Ministry of Environment, 2. Ministry of Agriculture 3. Water authorities <u>Regional:</u> 1. Regional authorities <u>Local:</u> 1. Municipal authorities and district offices 2. Municipal authorities with extended competencies	CENIA, Czech Environmental Information Agency Vrsovická 1442/65 Praha 10 100 10 Czech Republic Phone: (+420) 267 - 22 52 26 www.cenia.cz Jana Basistova Czech Environmental Information Agency Katerina Horakova	Ministry of the Environment of the Czech Republic Water Protection Department Vršovická 1442/65 Praha 10, 100 10 Phone: +420 267 121 111 Fax: +420 267 310 308 e-mail: info@mzp.cz https://www.mzp.cz/

Country	Main Institutions	Cooperation with European Environment Agency	National Contact
		Czech Environmental Information Agency Miroslav Havránek Czech Environmental Information Agency Nina Liberda Czech Environmental Information Agency **<u>Responsibilities:</u>** Ministry of Agriculture of the Czech Republic, Ministry of Environment of the Czech Republic - both responsible for status assessments and monitoring, preparation of Programme of Measures and RBMPs, pressure and impact analysis, public participation and reporting to the European Commission) as well as 14 regional authorities, which are responsible for the implementation of measures, preparation of Programme of Measures and preparation of the RBMP.	
Estonia	**Responsible ministries/bodies** <u>Central:</u> 1. Ministry of the Environment (Water Department, Marine Environment Department and Fisheries Department) 2. Estonian Environment Agency 3. Estonian Environmental Board 4. Estonian Environmental Research Centre	Indrek Laas Monika Kont Estonian Environment Agency Mustamäe tee 33, Tallinn 10616 Phone: +372 666 0901 Fax: +372 666 0909 e-mail: kaur@envir.ee https://keskkonnaagentuur.ee/en	Ministry of the Environment Narva rd 7, 15172 Tallinn Phone: +372 626 2802 e-mail: keskkonnaministeerium@envir.ee Estonian Environment Agency Mustamäe tee 33, Tallinn 10616

Country	Main Institutions	Cooperation with European Environment Agency	National Contact
	5. Ministry of Social Affairs Local: Local government/authorities	**Responsibilities:** The main three competent authorities: The Ministry of Environment, the Environmental Board and the Environment Agency. The Ministry of Environment is responsible for: enforcement of regulations; economic analysis; preparation of the RBMP and PoM; public participation, and; coordination of implementation. The main role of the Estonian Environmental Board is the implementation of measures. The Estonian Environment Agency is responsible for the monitoring and assessment of groundwater and surface water, pressure and impact analysis and reporting to the Commission.	Phone: +372 666 0901 Fax: +372 666 0909 e-mail: kaur@envir.ee
Hungary	**Responsible ministries/bodies** Central: 1. Ministry of Interior 2. General Directorate of Water Management Regional: 1. Regional Water Directorates 2. Counties Local: Local authorities	Gabriella Jelinek Ministry of Interior 1051 Budapest, József Attila utca 2-4. Postal address: 1903 Budapest, Pf.: 314. Phone: +36-1-441-1000 Fax: 06-1-441-1437 e-mail of the customer service: ugyfelszolgalat@bm.gov.hu **Responsibilities:** The Ministry of Interior: monitoring of groundwater and surface water, economic analysis, preparation of the RBMP and Programme of Measures, implementation of measures, co-ordination of implementation and reporting to the European Commission.	MINISTRY OF INTERIOR 1051 Budapest, József Attila utca 2-4. Postal address: 1903 Budapest, Pf.: 314. Phone: +36-1-441-1000 Fax: 06-1-441-1437 e-mail of the customer service: ugyfelszolgalat@bm.gov.hu General Directorate of Water Management Free on-call service: +36 80 204240 Hungary

Country	Main Institutions	Cooperation with European Environment Agency	National Contact
		The Ministry has a support role for public participation. • The General Directorate of Water Management: assessment of the status of groundwater and surface water, pressure and impact analysis, preparation of the RBMP and Programme of Measures, public participation, and implementation of measures; the General Directorate has supporting roles for the monitoring of groundwater and surface water, economic analysis, co-ordination of implementation and reporting to the European Commission. • 12 sub-national water directorates are also reported: they have main roles for the monitoring and assessment of status of groundwater and surface water, pressure and impact analysis, preparation of the RBMP, public participation and implementation of measures; and a secondary role for the preparation of the Programme of Measures. • 11 Government Offices are listed at county level: they are responsible for the enforcement of regulations; in addition, seven of them are responsible for monitoring of groundwater and surface water. • 12 Disaster Management Directorates at county level are listed: these are responsible for the assessment of status of groundwater and surface water, enforcement of regulations, pressure and impact analysis and implementation of measures. In addition, the national Directorate General for Disaster Management has main roles for the enforcement of regulations and implementation of measures, plus a supporting role for the coordination of implementation.	

Country	Main Institutions	Cooperation with European Environment Agency	National Contact
		• The Geological and Geophysical Institute of Hungary has a main role for the monitoring of groundwater, and a supporting role for the assessment of its status. • The National Inspectorate for Environment and Nature is responsible for the enforcement of regulations. • The Prime Minister's Office has main roles for the monitoring of groundwater and surface water and supporting roles for the implementation of measures and the coordination of measures.	
Latvia	**Responsible ministries/bodies** Central: 1.Ministry of Regional Development and Local Government 2. Latvian Environment, Geology and Meteorology Centre 3. Latvian Institute of Aquatic Ecology Local: Municipalities	Janis Sire Latvian Environment, Geology and Meteorology Centre Maskavas iela 165, Rīga, LV-1019 Birojs: tālr. 67032600 Fax: 67145154 e-mail: lvgmc@lvgmc.lv https://videscentrs.lvgmc.lv/ **Responsibilities:** 1. The Latvian Environment, Geology and Meteorology Centre has main roles for: monitoring and assessment of groundwater and surface water, economic analysis, pressure and impact analysis, preparation of the plans and Programme of	Ministry of Environmental Protection and Regional Development Peldu Street 25 Riga, LV-1494 Latvia

Country	Main Institutions	Cooperation with European Environment Agency	National Contact
		Measures and implementation of measures; and it has a supporting role for public participation. 2. The Ministry of Environmental Protection and Regional Development's main roles are: the enforcement of regulations, public participation, implementation of measures and coordination of measures; and it has supporting roles in the monitoring of surface water and groundwater, pressure and impact analysis, preparation of the plans and Programmes of Measures and reporting to the European Commission. 3. The Latvian Institute of Aquatic Ecology's main role is the monitoring of surface waters; and supporting roles in the assessment of status of surface waters, pressure and impact analysis, and reporting to the European Commission.	
Lithuania	**Responsible ministries/bodies** <u>Central:</u> 1. Ministry of Environment of the Republic of Lithuania 2. Environmental Protection Agency 3. Lithuanian Hydrometeorological Service 4. Lithuanian Geological Survey 5. Regional Environmental Protection Departments <u>Local:</u> Municipalities	Environmental Protection Agency Environmental Protection Agency A. Juozapavičiaus Street 9 09311 Vilnius, Lithuania Telephone +370 70 66 20 08 Fax +370 70 66 20 00 https://aaa.lrv.lt/ NFP: Gediminas Dudenas	Ministry of Environment of the Republic of Lithuania A. Jakšto g. 4, LT-01105 Vilnius, Lithuania Phone: +370 7066 3661, fax: +370 7066 3663, e-mail: info@am.lt

Country	Main Institutions	Cooperation with European Environment Agency	National Contact
Poland	**Responsible ministries/bodies** Central: 1. Ministry of Climate and Environment 2. Ministry of Infrastructure 3. Ministry of Agriculture and Rural Development 4. Gospodarstwo Wody Polskie (National Water Agency) 5. Chief Inspectorate of Environmental Protection Regional: 1. Voivodeships; 2. Regional Water Management Boards 3. Regional Inspectorates for Environmental Protection carry out monitoring of water quality County level: Counties (powiats) Local Gminas and towns	Paweł Ciećko - Chief Inspector of Environmental Protection Anna Katarzyna Wiech - Director of the Department of Environmental Monitoring in the Chief Inspectorate for Environmental Protection National Focal Point NFP PL Małgorzata Bednarek Chief expert Department of Environmental Monitoring Phone: +4822 36 92 264 e-mail: m.bednarek@gios.gov.pl NFP PL Alternate: Anna Katarzyna Wiech Director of the Department of Environmental Monitoring Phone: +4822 36 92 281 e-mail: k.wiech@gios.gov.pl **Responsibilities:** 1. The Ministry of Environment has main roles in enforcement of regulations, implementation of measures and coordination of implementation; 2. The Ministry of Agriculture and Rural Development and the Ministry of Maritime Economy and Inland Navigation have main roles in enforcement of regulations and	Ministry of Climate and Environment: Wawelska Str. 52/54, 00-922 Warsaw, Poland phone: (+48 22) 36-92-900 helpline: (+48) 222-500-136 e-mail: info@klimat.gov.pl

Country	Main Institutions	Cooperation with European Environment Agency	National Contact
		implementation of measures; 3. The Ministry of Development has a main role in the enforcement of regulations. National environmental and health authorities are identified as Competent Authorities: 1. The General Director for Environmental Protection has main roles in enforcement of regulations and the implementation of measures. 2. The Chief Inspector of Environmental Protection has main roles in monitoring and assessment of status of groundwater and surface water, along with the enforcement of regulations and the implementation of measures. 3. The Chief Sanitary Inspectorate has main roles in enforcement of regulations and the implementation of measures. Authorities for water management and maritime issues are identified The National Water Management Authority has main roles in enforcement of regulations, pressure and impact analysis, economic analysis, preparation of the RBMPs and PoM, public participation, implementation of measures, coordination of implementation and reporting to the European Commission. 1. The Directors of the Regional Water Management Boards (seven are listed) each have main roles in enforcement of regulations, pressure and impact analysis, economic	

Country	Main Institutions	Cooperation with European Environment Agency	National Contact
		analysis, public participation and implementation of measures. 2. The Directors of Amelioration and Water Structures Authorities (formerly, Directors of the Authorities for Land Improvement and Water Facilities) have main roles in enforcement of regulations and implementation of measures. 3. The Directors of Inland Waters Navigation Offices (eight are listed) have main roles in enforcement of regulations. 4. The Directors of Maritime Offices (three are listed) have main roles in enforcement of regulations and in implementation of measures (except for the Director of the Maritime Office in Slupsk, who does not have a main role in the enforcement of regulations). Competent Authorities at regional level are identified: 1. The Marshals of the Voivodships, the Voivodes and the Governors of the districts all have main roles in enforcement of regulations and implementation of measures. 2. The Voivodship Inspectorates for Environment Protection and Voivodship Sanitary Inspectorates have main roles in enforcement of regulations and the implementation of measures. Finally, the municipalities also have main roles in the implementation of measures.	

Country	Main Institutions	Cooperation with European Environment Agency	National Contact
Romania	**Responsible ministries/bodies** Central: 1. Ministry of the Environment, Waters and Forests 2. National Administration Romanian Waters 3. National Environment Protection Agency Local: 1. Counties and municipalities 2. Inter-communal Development Associations	Ministry of the Environment, Waters and Forests Mihail Costache **Responsibilities:** 1. The National Administration "Romanian Waters" is responsible for the monitoring and assessment of status of groundwater and surface water, economic analysis, pressure and impact analysis, preparation of the RBMP and PoM, public participation, implementation of measures and reporting to the European Commission. 2. The Ministry of the Environment, Waters and Forests is responsible for the coordination of implementation and the enforcement of regulations	Romanian Ministry of Environment, Water and Forests/General Water Management Directorate (MMAP) 12, Libertatii Blv, Sector 5 Bucharest, Romania Phone: 004 021 316 38 74 Fax: 004 021 316 38 74 e-mail: srp@mmediu.ro http://www.mmediu.ro
Slovak Republic	**Responsible ministries/bodies** Central: 1. Ministry of Environment, 2. Ministry of Agriculture and Rural Development, 3. Slovakian Environmental Inspection 4. Water Research Institute Regional: Regions with delegated competences Local: Municipalities	Renata Grofova Ministry of Environment Slovak Environment Agency Tajovského 28 975 90 Banská Bystrica Slovak Republic Phone: +421 – 48 – 4374 284 E-mail: sazp@sazp.sk https://www.sazp.sk/ **Responsibilities:** Ministry of Environment is responsible for: monitoring and assessment of status of surface water and	Ministry of Environment of the Slovak Republic Námestie Ľ. Štúra 1 812 35 Bratislava Slovak Republic Phone: +421 800 144 440 e-mail: info@enviro.gov.sk

Country	Main Institutions	Cooperation with European Environment Agency	National Contact
		groundwater; enforcement of regulations; pressure and impact analysis; economic analysis; preparation of the RBMPs and PoM; public participation; implementation of measures; coordination of implementation, and; reporting to the European Commission.	
Slovenia	**Responsible ministries/bodies** Central: 1. Ministry of the Environment and Spatial Planning 2. Slovenian Water Agency Local: Municipalities	Urska Kusar Slovenian Water Agency Ministry of the Environment and Spatial Planning Vojkova cesta 1b 1000 Lublana Phone: 01 478 40 00 e-mail: gp.arso@gov.si www.arso.gov.si https://www.gov.si/drzavni-organi/organi-v-sestavi/direkcija-za-vode/ **Responsibilities:** Ministry of Environment and Spatial Planning is responsible for all main roles: monitoring and assessment of status of groundwater and surface water, enforcement of regulations, pressure and impact analysis, economic analysis, preparation of RBMPs and PoM, public participation, implementation of measures, co-ordination of implementation, and reporting to the Commission.	Ministry of the Environment and Spatial Planning Dunajska cesta 48 1000 Lublana Phone: 01 478 70 00 e-mail: gp.mop@gov.si https://www.gov.si/drzavni-organi/ministrstva/ministrstvo-za-okolje-in-prostor/

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